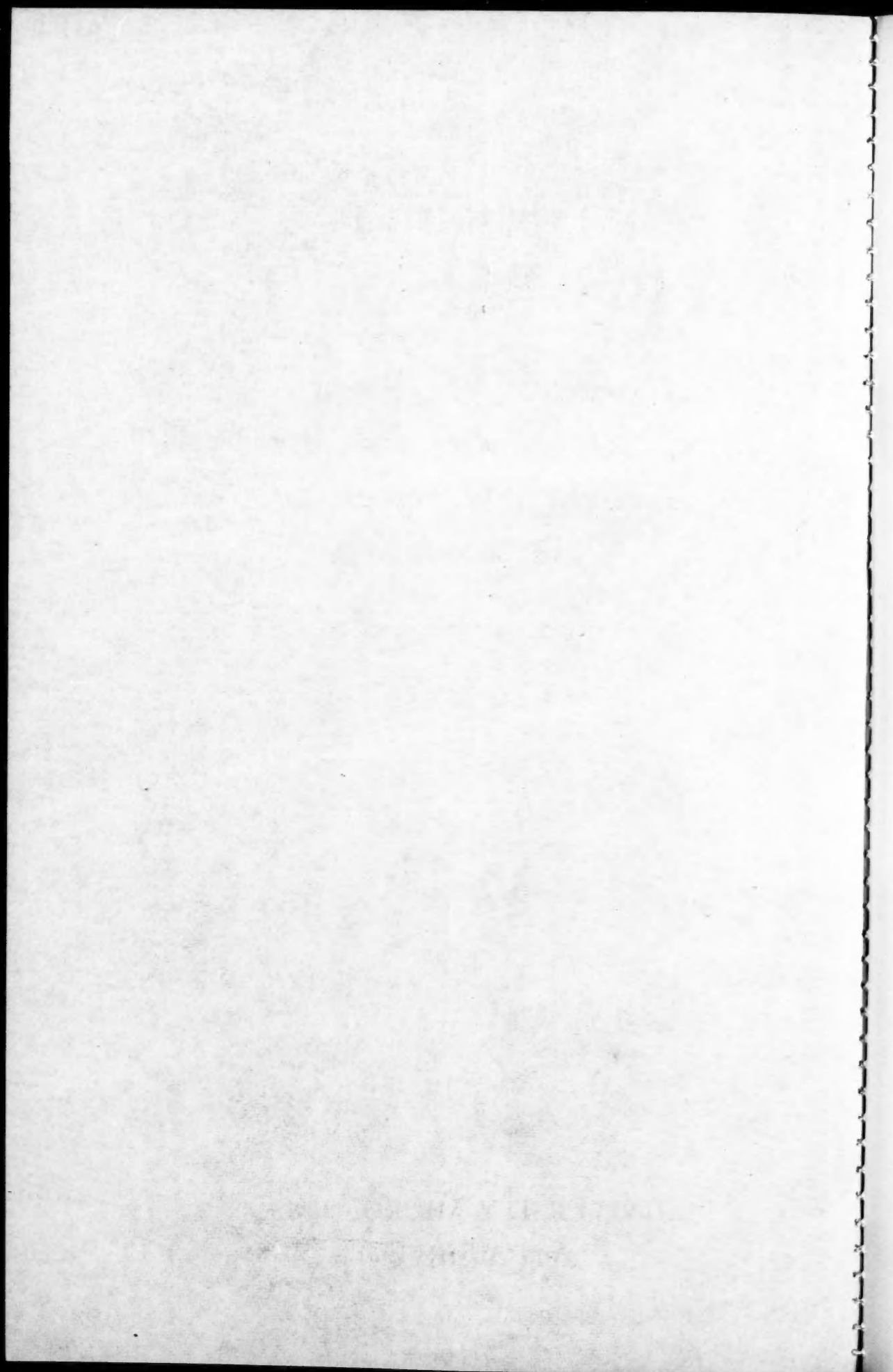


Vol. XI

No. 3

MICROFILM  
ABSTRACTS

*A Collection of Abstracts of  
Doctoral Dissertations and Monographs  
Available in Complete Form  
on Microfilm*





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UNIVERSITY MICROFILMS

Ann Arbor, 1951

ABSTRACTS

of the American Chemical Society  
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THE ASTORIA ASTORIAN

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The Astorian Press is a weekly newspaper published in Astoria, Oregon. It is owned and published by the Astorian Press Company. The paper is published every Monday except on holidays. It is a general news paper, containing local and foreign news, and is one of the leading papers of the city.

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PART I

The first part of the paper is devoted to the news of the day. It contains a full and complete account of all the important events of the day, and is one of the most reliable sources of information for the reader.

DISSERTATIONS

The second part of the paper is devoted to the news of the day. It contains a full and complete account of all the important events of the day, and is one of the most reliable sources of information for the reader.

The third part of the paper is devoted to the news of the day. It contains a full and complete account of all the important events of the day, and is one of the most reliable sources of information for the reader.

The fourth part of the paper is devoted to the news of the day. It contains a full and complete account of all the important events of the day, and is one of the most reliable sources of information for the reader.



## ACCOUNTING

### DETERMINATION OF INCOME IN ACCOUNTING

(Publication No. 2695)\*

Joseph Anton Silvoso, Ph.D.  
University of Missouri, 1951

In an evolving economy, accounting has had to keep pace with changing demands upon it. From a mere convenient recording device, it has grown to include the functions of control over operations and protection of interests of numerous contributors of capital.

Methods employed by accountants over past centuries were devised to solve given economic problems. Their development has been dictated by the varied forms of business organizations and the need for operating data by management, governmental agencies, investors, and others.

In the course of this evolution, accountants have recognized the need to integrate the various methods of recording incomes and costs to achieve greater accuracy in the measurement of the efficiency of management. A re-examination of fundamental accounting assumptions had to be undertaken to align them with this new objective.

A more accurate calculation of net income would result if an integration of accounting theory were achieved. Accounting rules must be related to accounting intentions. It is necessary to relate specific rules with reasons as the first step toward an integration of theory. Next, unity of theory would require an association of general rules with reasons. Finally, it would require a unifying thread which extends from practice through specific and general rules to fundamental principles of accounting.

Such a hierarchy of theory is a necessary means of building a bridge between the concrete facts to which accounts are applied and the theoretical basis of our social organization. Acceptance of such an interpretation of theory would result in accounts which are more valuable, because they afford more realistic and more useful accounting data. This result would stress greater accuracy of income figures. It would also tend to narrow the present wide range of accepted principles and practices of accounting. By providing insight into the problems of income determination, such a body of theory would tend to eliminate both intentional and accidental manipulations of the income account.

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A proper coordination of revenue debits and revenue credits presents a means by which to measure efficiency of management and to control operations. It is necessary to recognize as income all periodic inflows of services, which are objectively determined, and which result from performance in the income producing activities of a business entity. This general rule encompasses all of the acceptable specific rules employed in recognizing income in accounts. Each of the specific rules points to the foregoing general rule. The general rule, in turn, is dependent upon the accounting principle of equity or justice. It is also related to the principle of truth which is the essential base of accounting action as it is of all human conduct. An accurate matching of costs and incomes requires that all costs associated with recurring activities should be accumulated and charged to revenue.

The accounting process which is centered on income determination might well be stated as a process of coordinating three flowing streams associated with purposive income activities of a firm. First, there is the flow of income, second, the flow of costs, and third, the flow of time. An ideal coordination of these streams, in order to secure a highly dependable gauge by which to measure the efficiency of management and facilitate managerial control over operations, would require a coordination of costs with income, and then a coordination of both of them with time through the allocation of income to fiscal periods.

In early venture accounting, the emphasis was primarily upon a coordination of costs with incomes. With the adoption of periodicity, the emphasis shifted to a coordination of costs and incomes with time. More recently, the development of manufacturing cost accounting and attempts to apply cost methods to selling and general overhead costs represent a renewed effort to coordinate costs with incomes prior to their coordination with time.

Accounting technique is not static. The direction in which it is moving gives promise that we shall be able to measure with a greater degree of accuracy the efficiency of management by the calculated net income figure. More concretely, this will be accomplished by accurate recognition of costs and incomes for managerial guidance.



COMPARATIVE STUDY OF THE SYNTHESIS OF THE  
TEN ESSENTIAL AMINO ACIDS AND RIBOFLAVIN,  
NIACIN AND PANTOTHENIC ACID IN THE RUMEN OF  
CATTLE ON NORMAL AND PURIFIED RATIONS

(Publication No. 2490)\*

Indra Prasad Agrawala, Ph.D.  
Michigan State College, 1950

Experiments were designed to study the synthesis of the ten essential amino acids and riboflavin, pantothenic acid and nicotinic acid in the rumen of the cattle on both purified and normal rations. Three rumen fistula calves and one intact calf, each about six months old, were used in this study. The normal ration consisted of brome-timothy hay, a grain mixture and salt, while the purified ration consisted of corn starch, glucose, cellophane, lard, urea, and a mineral mixture. The quantity of the rations fed were sufficient to meet the protein and the calorific requirements of the animals. The calves were fed the normal ration for 15 days before changing to the experimental ration.

Samples of the rumen contents were collected by completely evacuating the rumen before feeding and at 6 hours after feeding. The samples to be analyzed for amino acids and B-vitamins were preserved in alcohol, then evaporated to dryness at 60° C. and ground for analysis. A small liquid portion of the rumen contents was taken for pH determination. A similar 5 ml. portion was preserved in 5 ml. of formalin for bacteriological analysis. Microbiological methods of assay were used to determine the ten essential amino acids and three B-complex vitamins.

The fistula calves developed anorexia and elevated body temperature after 10 to 15 days on synthetic ration, whereas the intact calf was normal when it was removed from the experiment after 21 days. The inclusion of 1 to 5 percent hay in the synthetic ration maintained the fistula calves in normal health.

The average pH values at 0 and 6 hours after feeding were 7.46 and 4.96, respectively, on experimental rations as compared to 6.88 and 5.28 on the normal rations. The total bacterial population and the iodophilic counts secured on the experimental rations were lower than those obtained on the normal ration. The passage of dry matter from the rumen in 6 hours was approximately the same on both the experimental and the normal rations.

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On the average, 9.3 gm. of arginine, 3.5 gm. of histidine, 9.0 gm. of isoleucine, 12.7 gm. of leucine, 9.9 gm. of lysine, 2.2 gm. of methionine, 6.4 gm. of phenylalanine, 8.6 gm. of threonine, 1.0 gm. of tryptophan and 9.7 gm. of valine were synthesized in 6 hours on the experimental rations as compared to 33.4, 12.1, 19.2, 41.1, 19.4, 5.6, 31.2, 22.0, 2.5, and 25.4 gm., respectively, on the normal ration.

The amounts of B-vitamins that were synthesized between 0 and 6 hours after feeding in the different trials on the experimental rations varied widely. Riboflavin synthesis ranged from 24.5 to 44.8 mg., pantothenic acid from 16.7 to 68.5 mg. and nicotinic acid from 83.8 to 353.2 mg. The quantities synthesized in the same period on the normal ration were 28.6, 58.2 and 189.4 mg., respectively.

Addition of 5 percent hay to the synthetic ration did not aid in the synthesis of the ten essential amino acids or the three members of the B-vitamins.

### COBALT POLYCYTHEMIA IN CATTLE

(Publication No. 2492)\*

George Merrill Ward, Ph.D.  
Michigan State College, 1951

Seventeen dairy calves between the ages of 12 and 191 days were allotted to 5 groups. One group received no supplement and the remaining groups received daily supplements of cobalt at the rate of 1 milligram per pound body weight, sulfaguanidine at the rate of 2 per cent of the dry matter intake or a combination of the preceding two supplements. The groups receiving sulfaguanidine were continued on the cobalt supplement after sulfaguanidine supplementation was discontinued. Eight yearling heifers were allotted to two groups, one receiving a daily cobalt supplement at the rate of 0.5 milligrams per pound body weight and the other receiving no supplement. The daily cobalt supplement was revised upward to 0.75 milligrams per pound after 84 days of supplementation and continued for an additional 28 days.

The red blood cell counts of calves receiving only the cobalt supplement starting in their second month of life leveled off at approximately 20 millions per cubic millimeter in 3 of the 4 cases. Concurrent increases in hemoglobin concentrations and red blood cell volumes occurred but at a lesser rate of increase, finally reaching equivalent levels ranging from 15 to 20 grams per cent

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and from 46 to 57 per cent, respectively. No change attributable to supplementation was noted in levels of total serum proteins, serum albumin, plasma calcium, plasma inorganic phosphorus, plasma magnesium, and plasma ascorbic acid.

Sulfaguanidine supplementation produced no apparent change in the blood picture. When cobalt supplementation followed or was in conjunction with sulfaguanidine administration, concurrent and equivalent increases occurred in red blood cell counts, hemoglobin concentrations, and red blood cell volumes but not to as great an extent as encountered with animals supplemented with cobalt only.

The severity of the polycythemia decreased as the animals approached the age of 30 weeks and animals which were approaching this age at the time when cobalt supplementation was started reacted in a like manner. No response to cobalt supplementation was noted in the yearling heifer group. The possibility was discussed that as the rumen microflora becomes well established and assumes normal numerical proportions the polycythemic effect of cobalt becomes less severe and finally reaches a point of no consequence.

Subnormal weight gains were encountered in all calves receiving the cobalt supplement. The control calves gained at a rate in excess of Ragsdale's standard. No difference in rate of gain between cobalt supplemented and control yearling heifers was noted.

It was concluded that cobalt is able to induce a polycythemia in calves at a time when their rumen microflora is not yet well established.

## ANTHROPOLOGY

### A STUDY OF CHEYENNE CULTURE HISTORY, WITH SPECIAL REFERENCE TO THE NORTHERN CHEYENNE

(Publication No. 2568)\*

Robert Anderson, Ph.D.  
University of Michigan, 1951

This study combines library research in the culture history of the Cheyenne, an Algonkian-speaking Plains group, and a synthesis of previous work on the tribe, with field data obtained on the Tongue River Reservation in Montana. The objectives were to write a history of the tribe, with particular reference to the northern division;

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to interpret selected aspects of the culture, and to ascertain those areas in which information concerning the culture is incomplete.

Previously, it has been assumed that the Cheyenne were a woodland people, whose culture was rapidly and completely transformed by assumption of Plains equestrian nomadism. It also has been assumed that Cheyenne social, and particularly political, organization represented a marked advance over that of Plains tribes in general.

The known history of the tribe as a whole has been sketched, from the time of the presumed first contact to settlement upon reservations in Oklahoma and Montana. The social and economic history of the northern group has been carried to the present. A synthesized account of nineteenth century Cheyenne culture is presented in its technological, sociological and ideological aspects. The critical approach employed is that which treats culture as a distinct body and level of phenomena, amenable to analysis in historical, functional, and evolutionary terms.

It is judged probable that the Cheyenne lived for an extended time on the prairie as semi-sedentary horticulturists and hunters. The main outlines of the culture were established before migration across the Missouri, and with few exceptions technological equipment and social features do not represent a significant change after that time. The most consequential new element in the post-contact period was the horse, which increased the energy potential of the weapons and tools previously available. Mobility had an effect on cultural forms, but the level of culture and its adequacy in terms of security and comfort was neither markedly increased nor lowered between 1750 and 1850, inasmuch as the energy increment due to use of the horse compensated for loss of limited agriculture. Cheyenne culture is interpreted as primitive, in the sense that subsistence was based on hunting and gathering, and the social (including political) organization was based upon kinship and other person-to-person relationships. The political organization was not advanced or strong enough to prevent a split into two tribes. Ceremonials and attitudes toward the supernatural are oriented toward hunting and war. Technology was found to be adequately described in the sources, and ceremonialism the least well described.

After 65 years of reservation life, the Northern Cheyenne are economically insecure. Aboriginal cultural manifestations which survive among them include ceremonials, migration and visiting during the summer months, attitudes toward property and sharing, and a limited amount of native medical practice.



# A COMPARATIVE ANALYSIS OF THE CULTURAL REMAINS FROM EARLY ANCON AND EARLY SUPE, PERU

(Publication No. 2528)\*

John Maxwell Corbett, Ph.D.  
Columbia University, 1951

In 1941, under the auspices of the Institute of Andean Research, excavations were conducted at the coastal sites of Ancon and Supe, Peru, in the shell and refuse middens which were reputedly "early" in their cultural content. First noted by the German scientist Uhle in 1904 and 1905, the remains from these shell middens seemed to be similar to other remains characteristic of the "Chavinoid" period uncovered elsewhere in Peru during the nineteen-thirties. On the basis largely of grave superimposition the Chavin horizon was generally considered to be the earliest major period in Peruvian prehistory, preceding such better known ones as Mochica, Tiahuanaco and Chimú. The excavations were carried out in an attempt to solve four problems: (1) to secure better data from the two sites of Ancon and Supe; (2) to discover the cultural relationship between the ceramic material from the shell middens at each site; (3) to determine, if any, the growth within itself of a culture entity known as Early Ancon-Supe; and (4) to ascertain the status and relationship of the Early Ancon Supe material to other Peruvian cultures.

Several strata-tests at Supe in three different localities and two strata-tests at Ancon were made in those areas where it was thought the most information would be gained. A laboratory analysis of the material recovered from these test pits was made in New York and the results form the body of this report. The framework for a sequential development at Ancon-Supe was made primarily on the basis of a comparative pottery analysis. Twenty-two types were set up: fifteen decorated and seven plain. These pottery types showed the development and change undergone by the Early Ancon-Supe ceramics throughout the time span represented by the shell middens. They helped to place Supe ceramics in relation to those of Ancon as a later and decadent form of Ancon pottery. Using the development based on ceramics, the non-ceramic remains from each site were placed in relation to each other and then the total cultures of each site compared.

The Early Ancon-Supe people were agriculturists, supplementing a vegetal diet with sea food. Both sea and land mammal bones

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were found as well as cultivated plant remains. Cotton and wool were used for textiles. Both twined and twilled baskets, gourd containers, string fish nets, rope, hammer stones, mauls, metates, bone implements, decorated and plain pottery and even a portion of a feather headdress were uncovered in the excavations. One piece of gold from Supe showed at least a slight acquaintance with metallurgy.

Of the four problems presented for possible solution through an analysis of the materials recovered from the Ancon-Supe excavations, the first was answered by the excavations themselves. The second, the relationship of the Ancon ceramic material to that of Supe, it was shown that the Supe ceramics paralleled the later phases of the Early Ancon period. The Ancon and Supe ceramics are two basically similar but technically variant manifestations of Coastal Chavin pottery. The growth of a cultural entity within itself, known as Ancon-Supe, was more difficult to prove. It appeared in the light of the analysis that the Early Ancon-Supe people received more in the way of outside influences than they gave in return.

The fourth and last problem, the status and relationship of the Early Ancon-Supe shell mound material to other Peruvian cultures, remains to be demonstrated stratigraphically. However, its placement as early and contemporaneous with other stratigraphically demonstrable early cultures of the Coastal Chavin period is based on the similarity of the pottery, the basketry, netting, metal working, stone tools, and designs carved on the gourd, the bone found by Uhle and the recent discoveries at Ancon reported by Carrion. Ancon-Supe ceramics are similar to those of both Chavin de Huantar and Cupisnique in the Chicama valley. In later phases the Early Ancon-Supe ceramics include some types which are similar to comparable types from the subsequent White-on-Red period in the Chancay, Viru, and Chicama valleys.

The Early Ancon-Supe phase of the Coastal Chavin period seems to be one in which a pottery-making people, possibly agriculturists at the start, arrived in the Ancon and Supe valleys and established themselves on a fairly simple fishing and agricultural level. Shortly afterwards, they were influenced by Chavin ideas which were reflected principally in their ceramics. Gradually, the ceramic manifestations changed and became decadent. The trends which would later crystallize in the White-on-Red period as painting rather than incising began to develop. Although surrounding areas at both Ancon and Supe continued to be occupied throughout most of the subsequent periods, toward the close of the Coastal Chavin period the shell midden sites were abandoned, not to be reoccupied.



## THE ROLE OF CADDOAN HORTICULTURALISTS IN CULTURE HISTORY ON THE GREAT PLAINS

(Publication No. 2537)\*

Preston Holder, Ph.D.  
Columbia University, 1951

This study examines the part which native horticultural societies played in the cultural changes occurring on the Great Plains of North America between the 16th and 20th centuries. It demonstrates that major changes occurred among some native groups as a result of the adoption of European cultural elements, and a new cultural orientation of equestrian nomadic bison-hunting was achieved. Nevertheless some major horticultural groups preserved ancient native traditions and remained horticultural to the end. The study demonstrates the thesis that the reasons for this conservatism on the part of the horticulturalists was basically socio-economic and resulted from ancient indigenous social developments which were in essential conflict with many of the new elements resulting from contact with European cultures.

The historical details of the transplantation of Western European cultural patterns to the New World and their development are examined insofar as they relate to the indigenous peoples of the Great Plains and important surrounding areas. It is shown that the main pattern of Western European expansion followed commercial lines in order to exploit the resources of the New World to the advantage of growing European industries.

The basic pattern of the aboriginal society of the Caddoan-speaking peoples is reconstructed from archeological evidence, ethnographic accounts, and the European historical records. The prehistoric roots of this pattern are examined in some detail, and some of the variations exhibited by the sedentary Siouan-speaking peoples are discussed. Conflicts between the various horticultural groups and between these groups and the expanding European peoples is examined.

The pattern of equestrian nomadism is discussed. The details of the way of life of a typical equestrian nomadic people, the Dakota Sioux, are presented. An analysis of this pattern is made. The conflicts between the nomadic groups, the horticulturalists, and the European representatives are examined as they influenced culture-change on the Great Plains.

\* Microfilm copy of complete manuscript of 152 pages, \$1.90.  
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The study shows that the acceptance of the horse alone, did not force true nomadism in the Plains environment; that the Caddoan horticulturalists had incorporated the horse into their culture without disrupting or significantly re-orienting the basic pattern of their existence. This pattern was the structuring of an ancient sedentary way of village life which possessed a rigid socio-political organization reinforced by a complex religious ideology.

Various factors transformed the world in which these peoples lived: the emergence of equestrian nomads, their growing numbers and strength, the consequences of European penetration, trade and conflict. In the face of a very real crisis which these new elements produced ancient horticultural society began to fracture but its integrity was maintained so that the final picture was not one of semi-nomadism, but of a way of life organized around the continuity of horticulture and the maintenance of the stable village.

In the absence of fully developed pastoralism on the Great Plains the acceptance of nomadism by these people would have represented a move away from the security afforded by the horticultural way of life. The presence of class distinctions within the villages and the supporting religion were the primary factors motivating the individual to retain the security which horticulture afforded with the conception that this security was the result of the functioning of these factors.

#### THE INFLUENCE OF EUROPEAN CULTURAL CONTACTS UPON THE ABORIGINAL CULTURES OF NORTH FLORIDA

(Publication No. 2653)\*

Hale Gilliam Smith, Ph. D.  
University of Michigan, 1951

The purpose of this study is to analyze and synthesize the archaeological and historical materials pertaining to the effects of diverse European (Spanish and English) cultures upon the aboriginal cultures of Florida and Georgia. This analysis and synthesis has viewed the culture change reflected in archaeological materials from the inception of European influences into this area up to 1800 A. D.

In Part I the various aboriginal culture areas and periods immediately prior to and after the discovery period are described

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in order that the prehistoric archaeological background may be understood more fully.

In Part II the Early Period (1500-1600) is discussed in the light of the first European contacts with the Florida Indians with an account of the various expeditions to Florida during the sixteenth century. Following this a complete discussion of all known archaeological sites yielding European trade of this period is presented.

In Part III the Middle Period (1600-1700) is presented. Historic references to the Spanish activities in Florida are noted and discussed. During this period the attitudes and actions of both the Spanish and the Indians had changed from those of the Early Period. The archaeological sites with material from this period are described. These are mission sites for the most part.

In Part IV there is a review of the Late Period (1700-1800). This period reflects the waning of Spanish power and the growth of English influence among the Indians. After James Moore's raid of 1704, the extensive mission chain through north Florida was broken. We also see that this period bridges a political shift of control from Spanish to British and also witnesses an almost complete breakdown of the aboriginal material culture. Finally the archaeological sites pertaining to this period are presented.

Part V includes a discussion and description of sites that had a continuous Spanish-British occupation. Sites of questionable placement are also included in this section.

In Part VI the English-Indian trade in Georgia is analyzed.

In Part VII certain aboriginal materials that serve as time markers of protohistoric and historic periods in Florida are noted: stone discoidals, balls, casuela vessels, shell gorgets and knobbed shell pins.

In Part VIII the Spanish cultural influences in Florida are contrasted with English cultural influences in Florida and Georgia.

The following conclusions may be drawn from the study: 1) The difference in material culture of the English and the Spanish had a direct influence upon what items were retained or discarded in the material culture of the various aboriginal groups contacted by the respective political powers. 2) The Spanish attitudes and policies emphasized the conversion of the Indian to Christianity and maintained the Indians as functioning primitive groups in a somewhat peasant relationship to the missions and forts. Thus change in the social and religious systems of the Spanish-Indians was a slow gradual shift which did not markedly affect their economic and tribal patterns. 3) The English policy of furnishing the Indians with firearms, a continuous supply of metal tools, utilization of Indian groups in an interarea war, and removal of conquered peoples, resulted in more rapid changes in the material culture than was present among the Spanish Indians. The English thereby shattered

the aboriginal material culture and effectively destroyed large tribal units. 4) The almost complete breakdown of aboriginal culture in Florida occurred within a span of about 100 years. This breakdown came about in the Middle Period (1600-1700) when there was strong Spanish influence within the area.

## ASTRONOMY

### THE EQUIVALENT WIDTH VARIATIONS OF CERTAIN HIGH EXCITATION LINES ACROSS THE DISC OF THE SUN

(Publication No. 2633)\*

Robert Milton Page, Ph.D.  
University of Michigan, 1951

This is an investigation of high excitation line formation, based on observations of the equivalent width variations of a group of carbon and silicon lines across the disc of the sun. The principal aim of the study is to provide a test of the theories of pure absorption, using as few approximations as possible in the mathematical solution to the problem.

The solar emission function used in this analysis is derived from observations of limb-darkening in the continuous spectrum. The temperature distribution is obtained from the emission function by assuming that  $T = T_{\text{eff}}$  at an optical depth of 0.7 in the continuum. The boundary temperature is found to be  $3700^{\circ}$ .

Theoretical equivalent widths are calculated under the assumption that mean values of the ratio of effective and Doppler widths, the partition function, and the Doppler width are applicable throughout the entire solar atmosphere. These assumptions are shown to be valid by means of exact calculations carried out for the lines of one excitation potential.

Theory and observation are compared by means of curves showing the equivalent width variations across the solar disc. The general agreement between the observational data and theoretical calculations based on pure absorption is found to be good, although there are systematic discrepancies which increase progressively with excitation potential. These discrepancies are examined by changing the run of excitation temperature. The results strongly

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suggest that the temperature distribution used in the theoretical calculations should be increased near the boundary of the sun.

The general conclusion drawn from this study is that the theories of pure absorption will explain the formation of the high excitation lines under investigation, although unexplained anomalies exist in the temperature and emission function near the boundary of the sun.

## BACTERIOLOGY

### A SEROLOGICAL AND ELECTRON MICROGRAPHIC STUDY OF THE BOVINE FIBRINOGEN - RABBIT ANTIBOVINE FIBRINOGEN REACTION

(Publication No. 2570)\*

Robert Coburn Backus, Ph.D.  
University of Michigan, 1951

The objective of this study was the examination of the mechanism of the inter-molecular reaction between an antigen and its homologous antibody.

Rabbit antibody production was followed by precipitin titres and a novel antigen inhibition test first introduced in this work. Progressive purification of fibrinogen was followed spectrophotometrically beyond 90% convertability of protein to fibrin. The antibody was obtained as a constituent of rabbit- $\gamma$ -globulin by alcoholic fractionation. The reactants were deposited in spray-droplet patterns which served as unit fields for observation in electron micrographs. Indicator particles were employed for identifying and following dilutions of the reactant protein molecules with the microscope.

Results of the study are:

1. Rabbit antibovine fibrinogen is highly specific for its homologous antigen.
2. The antigen-antibody complex resulting from interaction is not readily dissociable by changes in pH and/or salt concentration.
3. Plasma protein "macromolecules" are observable by the technics employed as discrete entities in high dilution. They appear to be made up of smaller sub-units that may exist as separate entities.

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4. The rate of precipitate formation in the reaction can be observed microscopically.

5. Microflocs indicate structural changes involving the molecules of the reactants, the integrity of the sub-units being altered.

It is concluded that:

1. The plasma macromolecular entities and their interactions in partially purified suspensions can be observed by the technics employed.

2. "Molecules" of fibrinogen and serum globulin are probably not definable (except statistically) as to exact size and shape.

3. The product of the antigen-antibody interaction does not appear to be a composite of the units making up the protein reactants, from which it is concluded that the molecules suffer structural (not necessarily irreversible) changes.

#### A STUDY OF THE IMMUNIZING PROPERTIES OF FRACTIONS OF THE TUBERCLE BACILLUS AND A CORRELATION OF THESE PROPERTIES WITH THEIR INFRARED SPECTRA

(Publication No. 2652)\*

Donald Ward Smith, Ph.D.  
University of Michigan, 1951

This investigation involved the preparation of fractions from cultures of virulent human tubercle bacilli, and the determination of their immunizing properties. In addition preliminary studies on the application of infrared spectroscopy as a guide to the isolation and identification of these fractions are reported.

Mass cultures for fractionation were prepared by growing the Olson strain of the human tubercle bacillus on malic acid medium (modified Long's). When sufficient growth had taken place, the medium was withdrawn and discarded and the cells were killed by allowing them to stand in alcohol for several days. Later the alcohol was separated by filtration and the washed cells were extracted in a ball mill with chloroform. This chloroform-soluble material and several sub-fractions made from it were then used, along with BCG and an ultraviolet irradiated vaccine, to immunize animals (primarily mice). After a suitable length of time the immunized animals and a group of controls were challenged with a suspension of virulent tubercle bacilli. One to three months later the animals were sacrificed and the degree of tuberculosis recorded.

\* Microfilm copy of complete manuscript of 97 pages, \$1.21. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A51-393.



The following results were obtained: The chloroform-soluble fraction in several instances induced a state of increased resistance in mice which compared favorably with that produced by BCG. An acetone-soluble fraction, prepared from the chloroform-soluble fraction, appeared to lower the resistance of the mouse when it was compared under similar experimental conditions.

The phase of this study which has most retarded the developmental progress has been the time-consuming in vivo testing of each antigen. This fact stimulated the search for a physico-chemical measurement which would provide an empirical correlation between the immunizing properties of the fractions and some readily measurable quantity. It was realized at the outset that a large amount of data would be required in order to obtain such a correlation. However, infrared spectroscopy would be immediately useful in determining whether fractions prepared at various times, apparently by the same procedures, possess the same chemical compounds and it would also be useful in suggesting chemical separations to be made in producing fractions.

Ground work has been laid for this study of applications of infrared spectroscopy to the characterization of the tubercle bacillus and its various fractions. To this end a high degree of reproducibility of any fraction of a given strain has been attained. The effect on reproducibility of the age of the culture, variations in the amount of solvent used, effect of breaking up the cells, variations in the length of time of extraction, presence of excess moisture on the cells at the time of extraction, and variations in temperature of drying the samples after extraction have been examined. The importance of the solvent or solvents used in obtaining the fractions has been established.

## BIOGRAPHY

### THE MARQUIS DE SADE AND THE ENLIGHTENMENT

(Publication No. 2558)\*

Robert Edward Taylor, Ph.D.  
Columbia University, 1951

Justly one of the most colorful figures of the eighteenth century, Sade has long been one of its most maligned and legendized characters.

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\* Microfilm copy of complete manuscript of 238 pages, \$2.98.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-301.

In recent years, largely because of the surrealists, the marquis has emerged for many as a kind of symbol of freedom from all restraints as well as from tyranny. Not until this present study, however, has anyone attempted to put his thoughts and convictions side by side with those of the other writers and thinkers of his age. This study does that systematically in the various realms of his activity: atheism, social reform, political theory, and sexology. An attempt is made to evaluate Sade in each of these fields and to contrast his contribution to each one with others of the Enlightenment. It is most clearly demonstrated, perhaps, that he went farther than his contemporaries in the field of atheistic materialism and that he created out of his own imagination, wrought to a turbulent peak from years of enforced abstinence, a new set of values that would later make up the science of sexology.

A sketch of Sade's life opens the book. There the myths are disposed of by reference to established facts, in many cases to court room records. The truth that is left, however, is even more interesting than the legends. In conclusion, there is a discussion of the man and the writer in which Sade's personal letters, some of them brought to light only in 1949, are used to help show why he wrote as he did.

The study closes with a selected bibliography which includes certain items, written by Sade himself, which have never before been listed in a bibliography on the subject. The list of books referred to is twenty-four pages long. The whole study encompasses some two hundred thirty-five pages.

**ROBERT MORRIS, REVOLUTIONARY FINANCIER:  
WITH SOME ACCOUNT OF HIS EARLIER CAREER**

(Publication No. 2559)\*

Clarence Lester Ver Steeg, Ph.D.  
Columbia University, 1950

This study is an attempt to examine the private and public career of Robert Morris throughout the Revolutionary period, with particular attention to his significant role as Superintendent of Finance.

The business career of Morris during this period breaks down into three distinct phases, 1757-1775, 1775-1778, 1778-1781. In the first two phases, Morris was associated with Thomas Willing in the

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\* Microfilm copy of complete manuscript of 442 pages, \$5.53.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-302.

firm of Willing and Morris. Beginning in 1757 with a few ships and a moderate trade, Willing and Morris prospered. By 1775, they owned nearly three times as many vessels, lands in Pennsylvania, a large plantation, and important property in Philadelphia itself. At the outbreak of the Revolution, Willing and Morris used their resources to exploit the various trade and contract opportunities which opened up. They were particularly successful in running the blockade to the West Indies — for the most part Martinique — although their plans and objectives reached out to envelop many of the colonies, the West Indies, and France. In these years, Morris also played a prominent role in the Continental Congress. His position on the Secret Committee of Correspondence (later called the Committee of Commerce) which managed much of the Congressional purchases from abroad aroused a considerable amount of criticism. Charges of mishandling public funds were made against Morris, a charge which is examined in this study but not completely solved because of a lack of evidence. In 1778, Willing and Morris severed their partnership. From that date until 1781 Morris's personal business connections mushroomed. By 1781, he was engaged in at least nine full-time partnerships, as many "semi-partnerships," and numerous lesser commitments. His energy in business affairs carried him to the front rank of American merchants. It also placed him in the public eye at a time when the revolutionary war efforts were seriously hampered by the collapse of public credit.

Morris entered into the newly created post of Superintendent of Finance in the early summer of 1781. At first, he was so occupied with immediate problems that he was unable to formulate any permanent policy measures. After the Yorktown campaign, however, the Financier introduced a significant long range program centering around a single object, the restoration of public credit. However, the program included in its sweep administrative reform within the department of finance, new devices and methods in the collection of revenue, contracting as a means of supplying troops, and curtailment of excess expenditures. Most important were the direct financial devices — a national bank, an extensive funding plan, a national mint, and time and sight notes issued by the Superintendent of Finance called "Morris notes." When Morris had finally worked out his program on public credit, it forecasted precisely that of Hamilton under the new government with one exception, the Report on Manufactures. Thus Morris attempted to nail to the Confederation the identical financial program which Hamilton later nailed to the new government. Most of this study is concerned with the working out of the Morris program. In much of it, the Financier was successful; however, in his financial plan — his most cherished object — he failed. The primary factor which worked against success was the declining course of trade which in turn caused

severe economic stringency throughout the country. Contributory certainly was the nature of the Confederation itself.

### JOHN B. STALLO'S CRITICISM OF PHYSICAL SCIENCE

(Publication No. 2561)\*

George David Wilkinson, Ph. D.  
Columbia University, 1951

John B. Stallo (1823-1900) immigrated to the United States from his native Germany in 1839. He studied and taught in Catholic schools. As an ordained priest he taught the natural sciences and Latin at St. John's College (later Fordham University). He left St. John's in 1847, and a year later published his General Principles of the Philosophy of Nature.<sup>1</sup> Renouncing his ordination vows and his Catholic faith, he studied law, and embarked upon a successful legal career which culminated, in 1885, in his appointment as Ambassador to Italy. He remained in Italy with his family after the expiration of his term of office, and died in Florence in 1900.

In the history of American philosophy he is remembered chiefly for his second major writing, The Concepts and Theories of Modern Physics.<sup>2</sup> His only other book was a collection, in German, of speeches and articles produced while he was a leader in the German cultural movement in Cincinnati.<sup>3</sup>

Stallo's General Principles of the Philosophy of Nature was a criticism of the materialistic science which prevailed in his day, based upon his wholehearted acceptance of the Romantic notion of the organic view of nature. He rejected the dualism which he considered Kant and Fichte to espouse, and opposed to it the Naturphilosophie developed by Schelling and Hegel, and systematically embodied in Oken's works.

\* Microfilm copy of complete manuscript of 167 pages, \$2.09. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A51-304.

<sup>1</sup>John B. Stallo, General Principles of the Philosophy of Nature: With an Outline of Some of its Recent Developments Among the Germans, Embracing the Philosophical Systems of Schelling and Hegel, and Oken's System of Nature. (Boston: Crosby and H. P. Nichols, 1848).

<sup>2</sup>John B. Stallo, The Concepts and Theories of Modern Physics (New York: D. Appleton & Co., 1881).

<sup>3</sup>John B. Stallo, Reden, Abhandlungen und Briefe (New York: E. Steiger and Co., 1893).



The Concepts and Theories of Modern Physics has been taken by many to be a repudiation of Stallo's earlier book, but it has many points of similarity. It is, for example, a vigorous criticism of dualistic materialism, and a call for a drastic revision of contemporary scientific principles. The important difference between the two works is Stallo's acceptance of the empirical viewpoint. Whereas his first book criticized science on the basis of "Hegel's ontological reveries," his second demanded that science reconstruct its hypotheses to agree rigorously with empirical data. His main target was what he termed "the atomo-mechanical theory," but he also devoted attention to non-Euclidean geometries. Together with his rejection of the Hegelian approach went an appreciation of Kant based upon an understanding which was completely lacking in his earlier book. His chief demand was that science, in particular physics, purge itself of the latent metaphysical prepossessions which lay at the foundations of materialism.

The important arguments of the Concepts were lifted in wholesale fashion from the British positivists of its day, Mill, Whewell, and Spencer. But although virtually everything in it had been written elsewhere, the original material was too weighty to be widely read, and the straight-forward exposition of Stallo's work made it understandable to a large number of readers who would have found Mill's Logic difficult. Although frequently considered to be an original and powerful critique of materialistic science, and one of the foundation stones of the thinking characteristic of modern logical positivism, the chief value of The Concepts and Theories of Modern Physics lies not in its originality, but in the clarity and forcefulness of its presentation.

## BIOLOGICAL CHEMISTRY

### STUDIES ON THE METABOLISM OF ACETONE

(Publication No. 2549)\*

Thomas Duane Price, Ph.D.  
Columbia University, 1951

Acetone labeled with  $C^{14}$  in the methyl positions was administered to rats at a dosage level of 0.1 to 0.7 mg. per 100 gm. of body weight. At least 50% of the radioactive carbon was oxidized to

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\* Microfilm copy of complete manuscript of 82 pages, \$1.03.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
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carbon dioxide and exhaled in the respiratory air within 24 hours; radioactive carbonyl compounds excreted through the lungs contained less than 10% of the administered radioactive carbon. The results show that acetone is efficiently metabolized in the normal intact rat but the oxidation is slow compared to that of most metabolites on major metabolic paths.

An alloxan-diabetic rat oxidized radioacetone to carbon dioxide at a rate similar to that found with normal rats. In both animals the acetone oxidation proceeded via a rapidly metabolized acetylating agent.

The mechanism of the biological oxidation of acetone was studied by administering labeled acetone to rats and determining the distribution of labeled carbon among and within compounds isolated from body tissues. The relative isotope concentrations of the acetyl component of excreted acetaminophenylbutyric acid, visceral fatty acids, and carcass glutamic and aspartic acids indicate that acetone is metabolized to form a  $C_2$  compound of metabolic behavior closely resembling that of acetate; chemical degradation studies on some of these compounds show the isotope to be distributed as it is after administration of methyl-labeled acetate. Biological

conversion of a  $CH_3\overset{O}{C}$ -segment of the acetone molecule to acetate is indicated. Relative isotope concentrations of visceral choline and carcass methionine, and the distribution of isotope in carcass serine show that the third carbon atom of acetone is extensively converted to a non-carbonate  $C_1$  compound. These findings point to the reaction, acetone  $\rightarrow$  acetate +  $C_1$ , as the predominant in vivo catabolic path of acetone.

The specific activity values of cholesterol and heme were found to be consistently higher, relative to the activities of acetylated amino acid and fatty acids, than has previously been observed after administration of methyl-labeled acetate. However, the distribution of isotope in the cholesterol, as shown by a partial degradation, demonstrates that acetone does not serve as a direct precursor of cholesterol. The distribution of isotope in cholesterol was consonant with the theory that acetone was oxidized to acetate and the latter served as the immediate cholesterol precursor. The relatively high activity of cholesterol and heme is ascribed mainly to a variation of isotope concentration of the acetate precursor resulting from differential acetone-oxidizing efficiency of different cells.

Evidence is presented that pyruvate and acetoacetate are not on a major in vivo catabolic path of acetone.

The mechanism of acetone oxidation was further investigated by in vitro experiments involving comparison, competition and dilution studies with labeled metabolites in rat liver slices. Acetate was found to be about three times as efficient a cholesterol precursor



as acetone in this system; only a negligible incorporation of formate into cholesterol and fatty acids was observed. Formate, acetate and acetone were oxidized to carbon dioxide in descending order of efficiency. Dilution experiments indicate that acetone is metabolized to cholesterol via acetate but not via pyruvate; preliminary findings indicate that the oxidation of acetone may proceed as far as pyruvaldehyde at which state a cleavage to  $C_2$  and  $C_1$  compounds occurs.

One-step degradation methods are presented for separation and isolation of the two carbons of glycine, the  $\gamma$ -carboxyl carbon of glutamic acid and the isopropyl group of cholesterol.

### URINARY EXCRETION OF HISTIDINE BY PREGNANT AND NON-PREGNANT INDIVIDUALS

(Publication No. 2667)\*

George Sherman Wells, Ph.D.  
University of Michigan, 1951

This study represents a comparison of the histidine content of the urine of normal men, pregnant women, and non-pregnant women. The purposes were to develop an accurate chemical method for the determination of urinary histidine which would be adequate for metabolism studies on this amino acid and to apply the method to the analysis of the urine of pregnant and non-pregnant individuals.

Urinary histidine has been determined by a modification of the bromine reaction discovered by Knoop. Since urea interfered with the color development, it was eliminated by autoclaving the urine before the determination of histidine. Since urine concentrations vary, the mg. of histidine per ml. of urine is not a true measure of histidine excretion. The amount of histidine excreted in 24 hours would be a better index of urinary histidine excretion but it is not always convenient to collect 24 hour urine specimens in the clinic. In order to overcome this difficulty the urinary histidine concentration was determined on autoclaved urine and compared with the urinary creatinine concentration determined on unautoclaved urine. The creatinine to histidine ratio of Langley was calculated for each urine specimen. This ratio gives a true indication of urinary histidine because creatinine excretion is constant for any given individual whether in the pregnant or non-pregnant condition.

\* Microfilm copy of complete manuscript of 114 pages, \$1.43.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-408.

The results of our studies were as follows:

1. The bromine method is specific for histidine.
2. The bromine method is satisfactory for the determination of urinary histidine.
3. Appreciable amounts of histidine are excreted by normal men and normal non-pregnant women.
4. There is no significant difference between the amount of histidine excreted in the urine by normal men and normal non-pregnant women.
5. There is an increase in the excretion of histidine during pregnancy. However, it is necessary to take into consideration the concentration of the urine in order to demonstrate this effect of pregnancy.
6. The creatinine to histidine ratio provides a satisfactory means to account for urinary concentration. During pregnancy this ratio is considerably lowered.
7. The increased histidine excretion during pregnancy does not occur before the second month of gestation and, therefore, cannot be used for the early diagnosis of pregnancy.

## BIOLOGY

### STUDIES ON THE BIOLOGY AND CONTROL OF LYGUS OBLINEATUS (SAY)

(Publication No. 2493)\*

Zia-ud-Din, Ph.D.  
Michigan State College, 1950

#### Part 1

Studies on the biology of tarnished plant bug, Lygus oblineatus (Say), were made because, in spite of low infestations, it causes considerable damage to crops.

"Lygus injury" varied with the crop and the part of the plant attacked, both in the test plants and in the field. Histological studies showed that necrosis started from the vascular bundles in the injured tissue.

The incubation period varied from eight to thirteen days at the mean temperatures ranging from 57.8 to 68.5° F. Nymphal development was affected similarly. The life-cycle was completed

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\* Microfilm copy of complete manuscript of 137 pages, \$1.71.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-236.

in 30 to 43 days. Females preferred chinese cabbage to beans for oviposition.

A record of variation in population of *L. oblineatus* was compiled by counting insects per hundred sweeps every three days during the years 1949-1950. No adult was found on wing between November 25, 1949 and March 25, 1950. There was no heavy injury to fruit buds due to high mortality during hibernation. No insect survived storage at 35° F.

The infestation was at its peak during August and September but rapidly declined with the drop in temperature in October.

The ratio of males to females was four to six in June, one to one in August and September and one to nine in mid-October.

## Part 2

1. Fourteen organic insecticides, at three concentrations were tested as contact sprays for the control of *L. oblineatus*. Ten insects were released on sprayed plants in each cage. Mortality counts were made every twenty-four hours. Maximum percent control is shown within parentheses in the following results.

a. Nicotine sulfate (42.9), nicotine sulfate + pyrethrum + sulfur (24.6), rotenone (6.6) and ryania (49.1) did not show satisfactory control.

b. Methoxychlor (0.0), Pestox 3 (23.3), and allethrin (25.0) proved ineffective.

c. DDT (85.7) and DDD (85.7) had a residual effect of six and five days respectively.

d. Toxaphene (70) showed the effect after 48 hours.

e. Chlordane (100), lindane (100), TEPP (100) and parathion (100) had residual effect of 6, 12, 0 and 4 days respectively.

TEPP hydrolyzed within three hours.

2. Field cage experiments were conducted for the control of *L. oblineatus* on celery. Three concentrations of lindane, four timings of sprays, and three intensities of infestation were used as variables. The harvested celery was analyzed on the basis of yield, percentage of injured stalks and number of punctures.

Four sprays increased the yield by 5.3 tons per acre over the check. This increase was reduced to 2.2 tons per acre with six sprays.

All three variables proved significant on the basis of percent injury and punctures. Four sprays of lindane at medium concentration gave satisfactory control. For better quality under high infestation six sprays were the best.

No off-flavor was detected in the treated celery.

3. Lindane, parathion, TEPP and a combination of nicotine sulfate, pyrethrum and sulfur were used in field trials for the control of *L. oblineatus* on chinese cabbage. The plots were laid out in

randomized blocks replicated six times. Lindane gave significantly better control than the other three treatments.

# TEMPORARY ELIMINATION OF THE AUTOSOMES FROM THE MEIOTIC SPINDLE IN A HALYINID PENTATOMID

(Publication No. 2544)\*

Barbara Adele Martin, Ph.D.  
Columbia University, 1951

In the testis of each male of the halyinid pentatomid *Alitocoris schraderi* examined a harlequin lobe is present. In the cells of this lobe meiotic chromosomes exhibit no pairing, and univalents are traceable throughout prophase. Metaphase I witnesses some chromosome associations in two's and three's which seem attributable to heterochromatic attraction. Other cells display complete independence of univalents.

Prior to second division all autosomes form an aggregate which is later expelled to the side of the cell by a pushing action of elongated chromosomal fibers while the sex chromosomes are arranged in the center of the spindle. During anaphase movement the autosomal aggregate enters the mid-spindle region. The movement of the sex chromosomes and the entrance of the autosomal mass into or close to the polar axis is shown to be correlated with at least two factors in second anaphase namely, chromosomal fiber shortening and spindle elongation.

Spermatids with variable numbers of chromosomes result from harlequin lobe meiosis.

The male specimen collected on the Pacific slope of Costa Rica differs cytologically from the males found on the Atlantic slope. The variation consists in the regular occurrence during meiotic prophase of wheel formations of split univalents united at their ends in a heterochromatic body.

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\* Microfilm copy of complete manuscript of 52 pages, \$1.00. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-287.



THE LICHEN-FORMING SPECIES OF THE GENUS *BUELLIA*  
OCCURRING IN THE UNITED STATES AND CANADA

(Publication No. 2607)\*

Henry Andrew Imshaug, Ph.D.  
University of Michigan, 1951

The purpose of this investigation has been to make a comparative morphological study of the lichen-forming species of the genus *Buellia* occurring in the United States and Canada and to determine their relationships. No previous study of a monographic nature has been made of this genus and the available information is found in many scattered, uncorrelated reports.

In the course of this investigation it was necessary first to collate all the available information and then to obtain more information by the critical study of as many specimens as possible. For this purpose material was obtained on loan from all the major lichen herbaria.

This comparative morphological study has shown that the microscopic characters of apothecial sections are the most reliable ones for delimiting species. The thallus, on the other hand, is very variable and it appears that these variations are due to the nature of the substratum.

Closely related species are grouped together in stripes. The structure of the exciple and hypothecium, upon which little emphasis has previously been placed, is considered to be of principal importance in the grouping of related species. Other characters which have previously been little emphasized are the presence or absence of oil drops in the hymenium and the thickening of the spore wall. Spore septation is considered to be of minor importance and is used only on the species level, if at all.

Descriptions of 42 species recognized as occurring in the United States and Canada are given and a key is provided for their determination. The distributions of the species have been analyzed and distribution maps are given for those species which are not limited to a small, well-defined region.

In the course of this study it has been found necessary to recognize 7 species as formerly undescribed in the literature. These are *B. amphidexia*, *B. fosteri*, *B. hassei*, *B. langloisii*, *B. lepidastroidea*, *B. pruinella* and *B. rappii*. One variety, *B. parasema* var. *poly-spora*, is also described for the first time.

\* Microfilm copy of complete manuscript of 223 pages, \$2.79.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-350.

Two species are transferred to the genus *Buellia* from other genera. These are *Gyrostomum curtisii* Tuck. and *Rinodina thomae* Tuck.

A total of 16 names are reduced to synonymy for the first time. These are *Karschia adnata* (= *B. zahlbruckneri*), *B. blasteniospora* (= *B. rinodinospora*), *B. blumeri* (= *B. retrovertens*), *B. cinereoglauca* (= *B. retrovertens*), *B. cohibilis* (= *B. thomae*), *B. lepidastras f. lignicola* (= *B. punctata*), *B. moreliensis* (= *B. thomae*), *B. pueblae* (= *B. retrovertens*), *B. pueblae* var. *plana* (= *B. retrovertens*), *B. pullata* (= *B. punctata*), *B. saxicola* (= *B. punctata*), *B. stipitata* (= *Karschia stygia*), *B. tehuacana* (= *B. thomae*), *B. tucsonensis* (= *B. retrovertens*), *B. turgescens* (= *B. turgescens*) and *B. vernicomoides* (= *B. vernicoma*).

#### TAXONOMIC STUDIES IN THE GENUS *ACHLYA* NEES

(Publication No. 2610)\*

Terry Walter Johnson, Jr., Ph. D.  
University of Michigan, 1951

The present study is concerned with a revisional taxonomic investigation of *Achlya*, a large and important genus of the Saprolegniales, an order of fresh-water and terricolous phycomycetous fungi. The data herein presented were obtained primarily from an examination of living specimens. In those few instances where living specimens or type material were unobtainable, reliance was, perforce, placed solely on the literature. The major developmental stages in the life history and reproduction of a representative species, *Achlya americana* Humphrey is included as typifying that undergone by other members of the genus.

Isolates of achlyoid fungi were obtained from over eight hundred soil and water samples collected during the course of this investigation. Wherever possible, living specimens from the collections of other investigators were also studied. All cultures were examined as bacterial-free, single spore isolates, propagated on halves of sterilized hempseed, in 30 cubic centimeters of sterile, charcoal-filtered, distilled water. Cultures were incubated at 22 degrees centigrade, and examined when they were one to two weeks old. Significant characteristics such as measurements and the like, were based on five hundred observations of each of the morphological features concerned.

\* Microfilm copy of complete manuscript of 368 pages, \$4.60. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-351.



It has been found that oospore structure, oogonial wall characteristics, position and shape of oogonia, and features of the oogonial stalk are the most consistently stable within the genus, and hence, the most useful criteria in establishing species concepts. Sizes of reproductive structures are of secondary importance in this respect, as are characteristics of the vegetative mycelium and asexual reproductive organs.

Certain taxonomic changes are effected. The following are reduced to synonymy: Achlya variabilis Hine, A. racemosa var. Hine, A. racemosa var. stelligera Minden, A. racemosa var. stelligera forma maxima Minden, A. Sparrowii Reischer, A. racemosa forma stelligera Minden, A. racemosa forma polyspora Schkorbatow, A. racemosa forma Pringsheimii Minden, A. apiculata var. prolifera Coker and Couch, A. oblongata var. globosa Humphrey, A. oligacantha var. brevispina Schkorbatow, A. acadiensis Moore, Aplanes Treleaseanus (Humphrey) Coker, A. decorata Petersen, A. turfosa Johannes, A. imperfecta Coker, A. flagellata var. yezoensis Nagai, A. androcomposita Hamid, A. Oryzae Nagai, A. Klebsiana var. indica Chaudhuri and Kochar, A. michiganensis Johnson, Leptomitius prolifer Agardh, Saprolegnia ferax Braun, A. polyandra forma americana Petersen, A. ocellata Tiesenhausen, A. deBaryana var. americana Minden, A. americana var. megasperma Crooks, A. tuberculata Ziegler, A. americana var. cambrica Trow, and A. regularis Coker and Leitner.

Achlya cornuta Archer, A. spinosa deBary, A. stellata deBary, A. aplanes Maurizio, A. flexuosa Nagai, A. dubia var. pigmenta Chaudhuri and Kochar, A. Kashyapia Chaudhuri and Kochar, and Achlya sp. Viégas and Teixeira, are considered species of unknown affinities.

Excluded species are A. Hähneliana Cejp, A. Nowickii Raciborski, Achlya sp. Schlösser, A. intermedia Bail, A. oidiifera Horn, A. ferax (Gruith.) Duncan, and A. Braunii Reinsch.

The general conclusion reached is that the genus Achlya has contained in the past a number of clearly invalid taxa, and that further reduction to synonymy of certain other species may be justified, especially in the subgenus Euachlya.

A FLORISTIC AND PHYTOGEOGRAPHIC SURVEY OF THE  
SOUTHERN SLOPES OF THE BROOKS RANGE, ALASKA

(Publication No. 2611)\*

Louis H. Jordal, Ph.D.  
University of Michigan, 1951

This study, based upon the collections and observations of two field seasons, deals with the vascular plants of the southern slopes of the Brooks Range in northern Alaska.

Because the Brooks Range occupies a central position between unglaciated regions and is close to "Beringia," the geologically late land bridge between Asia and America, an important center of endemism and Pleistocene dispersals, the botanical exploration of this remote and little known region was of great interest to phytogeographers.

The author's explorations were sponsored by the Botanical Gardens of the University of Michigan and the Arctic Institute of North America.

Introductory chapters deal with the physical factors of the region, the climate, soils, geology, paleogeography and glaciation, together with a historical summary of botanical and geographical exploration of the region. In a critically annotated list of the Characeae and vascular plants of the region are enumerated more than 550 taxa distributed within 175 genera and 53 families of vascular plants and the Characeae, with full citation of all collection records. A number of species are reported as new for Alaska and for a large number important range extensions are indicated. Five new species and several new forms were discovered.

After a critical and theoretical appraisal of earlier distributional concepts, the writer has assorted the plants into geographical groups under the three main categories "boreals," "arctics" and "montanes." Each of these groups is divided into geographical sections which are in turn divided into one or more regional subsections. Further classification is carried out with regard to certain distributional patterns of particular significance, e.g., those which obtain in the Rocky Mountain region where the cordilleran glaciers intervened between unglaciated Alaska-Yukon and the western United States. Several distributional categories are proposed which characterize these. Certain distributional patterns are also distinguished within the Brooks Range region itself.

\* Microfilm copy of complete manuscript of 411 pages, \$5.14.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-352.

Percentage tabulations are provided in which the chief distributional types are correlated. These show that the wide-ranging boreals and arctic-montanes predominate in the flora of the region. The more significant distributional categories and the degree of endemism are, on the other hand, so prominent that the floristic uniqueness of the region is well established. The data are summarized in the following table:

Geographic subdivisions	Boreals	Arctics	Arctic-montanes	Endem.	Total %
Circumboreals & circumpolars	14	5	16		35
Eurasianic	1	1 -	2 -		4 -
Asiatic	2	2 +	4		8 +
American-Asiatic	4	5	5		14
American	9	5 +			14 +
Para-Atlantics	1 -	1 -			1
Peri-glacials		4			4
Per-glacial Rocky Mountain	1.5		3.5		5
Cis-glacial Rocky Mountain	1 -		1 +		2
Alaska-Yukon tundra & montane endemics				7	7
Alaska-Yukon forest endemics				3	3
Beringian Tertiary relicts				1	1
Adventives	2 +				2 +
Total %	35	23	31	11	100

It is concluded that the prominent endemism is related to the fact that the region was only partly glaciated and lies in close proximity to unglaciated regions. It is also concluded that the Brooks Range has served as a veritable migrational cross roads, particularly for taxa of arctic-montane proveniences, but also for the more strictly arctic and boreal ones. The influx of Asiatic plants, which is considerable, was reduced, however, by the submersion of Beringia, and in earlier times undoubtedly also by the shifting formations which occupied the disappearing Beringian land surfaces. The influx of cordilleran species was obviously interfered with by the continuous ice sheets of the cordilleran glaciations. These ice sheets served to prevent the "trans-glacial" Rocky Mountain plants from reaching the Brooks Range region, and, conversely, prevented the "cis-glacials" from extending their ranges southward into the Rocky Mountain region from unglaciated Alaska-Yukon.

## THE NECKERACEAE OF NORTH AMERICA

(Publication No. 2665)\*

Kenneth A. Wagner, Ph.D.  
University of Michigan, 1951

This systematic monograph of the moss family Neckeraceae presents a classification of North and Middle American representatives in accordance with their evolutionary interrelationships insofar as this is possible from morphological and geographical considerations. Relationships are indicated by diagrams. A conservative concept of genera results in the reduction to synonymy of several generic names, leaving only ten as valid, namely, Homaliadelphus, Homalia, Neckeropsis, Homaliodendron, Neckera, Neckeradelphus, Calyptothecium, Thamnium, Pinnatella, and Porotrichum. Thirteen specific names, having more or less current recognition, go into synonymy. A number of species which have been referred to the family have been found to belong elsewhere, and their proper disposal is indicated.

The evolution of the family, as indicated by a study of leaf insertion, suggests closer relationship between the Homalia-Neckeropsis-Homaliadelphus developmental line and the Thamnioideae than between the former and Neckera. The new subfamily Homaliodeae is proposed to contain the genera of the Neckeraceae which have four rows of leaves.

The new species Thamnium tumidicaule, the new status Homalia Jamesii var. gracilis from Neckera gracilis and the new combinations Porotrichum neomexicanum from Porothamnium and Homaliodendron decompositum from Porotrichum are proposed.

Descriptive terms for the leaf apex were found to be too loosely used by former students to serve for the identification of specimens without actual comparison with authentic material. All angular measurements were therefore made instrumentally and terms were defined accordingly and used with precision. Typical material was mounted on microscope slides for preparing photographic illustrations by projection. The precise terminology and the presentation of a complete set of illustrations of carefully selected characteristic specimens, have, it is hoped, resulted in a practical treatment of the family.

The herbaria examined contained some four thousand different cited collections from the area covered, with enough overlap of

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identical specimens from herbarium to herbarium to insure that the material was representative, and that further examinations would yield mostly records of local interest, without greatly modifying the known geographic distributions.

## BUSINESS ADMINISTRATION

### HOLDING AND INVESTMENT COMPANY OWNERSHIP OF RAILROAD SECURITIES

(Publication No. 2523)\*

Robert Eugene Berger, Ph.D.  
Columbia University, 1951

This is a study of the ownership of securities of American railroad companies by holding and investment companies with emphasis on the period after 1920. The cases surveyed are the companies organized by the Van Sweringen brothers and their associates, The Pennroad Corporation, and the Pennsylvania Railroad system.

The use of holding and investment companies is treated as an aspect of the unification of railroads. The history of railroad combination and the progress of legislative control is traced culminating with the Transportation Act, 1920, the Emergency Railroad Transportation Act, 1933, and the Transportation Act of 1940. The use of parent operating holding companies, pure holding companies, and investment companies is studied as a national phenomenon.

The Van Sweringen rise to power in Cleveland after 1900 is developed including their real estate and terminal projects, the acquisition of The New York, Chicago, and St. Louis Railroad Company, and the later acquisition of control of the Chesapeake and Ohio, the Pere Marquette, and Erie railroads. The control is traced through a holding company pyramid with The Vaness Company and several other proprietary companies on top, a series of holding companies such as Alleghany and Chesapeake Corporations in the middle, and the railroads with security affiliates at the base.

It is determined that funds for the security purchases were obtained partly through bank loans and the use of non-voting preferred stock whenever possible. The climax, the organization of Alleghany Corporation (1929) which held ownership of the railroads

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through subordinate companies, is studied in detail, as is its largest investment of about \$100,000,000. in the Missouri Pacific.

The dependence for income chiefly on railroad and other stocks, reliance on borrowing, and the use of stocks to collateral Alleghany Corporation bond issues are found to be the chief Van Sweringen weaknesses, and the depreciation of market values after 1929 one of the main causes for their failure.

The Pennsylvania Railroad Company and the independently operated lines which it controls through stock ownership and which constitute the Pennsylvania Railroad system are studied. This is found to be a gigantic parent operating holding company system with an investment value of over three billion dollars in 1949. The system, it is determined, is controlled by the President and the Board of Directors of the railroad since the stock is so widely distributed that united action by the stockholders is likely to occur rarely if at all.

The management of the Pennsylvania Railroad conceived the idea of forming Pennroad Corporation and then financed it by selling its stock chiefly to the railroad's stockholders (1929). The use of a voting trust for ten years as a means of control is investigated. The evidence gathered indicates that Pennroad was to make profitable investments which would be beneficial to the railroad at the same time. It is noted that Pennroad seems never to have exercised control of its railroads, and that it claims that it has operated as an independent company.

Most of the railroads, and holding and investment companies surveyed suffered losses during the great wave of liquidation in the depression. These losses are stated.

The conclusion is that while holding and investment companies in the railroad field have demonstrated notable shortcomings in the past, they can be useful if used prudently, and if they work in coordination with an aggressive Interstate Commerce Commission, which in turn is backed by an efficient and sufficient Congressional mandate.



UNDISTRIBUTED PROFITS TAXATION  
IN AUSTRALIA, 1915-1949

(Publication No. 2527)\*

Lawrence David Coolidge, Ph.D.  
Columbia University, 1950

This study pertains to the methods employed by the Commonwealth of Australia in the taxation of retained corporate earnings during the period from 1915 to 1949. The focus of attention is upon the design of the Commonwealth tax on insufficient distributions, administrative problems encountered in the application of this device, and the experience of taxpayers in complying with its provisions. Related problems in the tax treatment of dividends are considered. The relationship of dividend policy to the incidence and effects of the various corporate income tax instruments is analyzed.

The objective of this undertaking has been to make available, for use in appraisal of proposals for revision of the United States Federal corporation income tax, a review of one substantial body of administrative and taxpayer experience — that of the Australian Commonwealth — with some of the most frequently suggested devices. Considerations of administrative practicability and facility of compliance, rather than of equity or fiscal productivity, are predominant.

The initial portion of the study is devoted to a review of the development of the Australian Commonwealth company tax system. Enduring elements in the system are examined: the definition of assessable income, the allowed and disallowed deductions, the statutory exemptions, the rate structure, and the treatment of capital gains. The changing provisions for the tax treatment of dividends, bonus shares, operating losses, and inter-company dividends are summarized. The techniques which were adopted for maintaining approximate tax equivalence as between incorporated and unincorporated business units and for preserving the identity of tax-exempt items are investigated.

The theoretical justification for a tax on insufficient distributions is then subjected to critical examination. The legislative and administrative development of the tax in Australia is traced. The principal court decisions bearing upon its provisions are reviewed. A detailed analysis is undertaken of six principal problem areas associated with the application of this type of tax: 1) the definition

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of "sufficiency" of distribution; 2) the status of bonus shares; 3) the timing of the notional distribution; 4) rebates in the event of subsequent distribution; 5) the applicability of the tax to companies with widely dispersed ownership; 6) the problem of tracing a notional distribution through intervening holding companies. Evidence relating to enforcement of the tax and compliance with its provisions, which was presented before the Royal Commission on Taxation, is reviewed in some detail and the recommendations of that Commission are appraised.

Final portions of the study are concerned with the relationship between the proportion of the company earnings distributed and the yield in revenue and distribution of tax burden which could be expected to result from application of each of the several Commonwealth company tax devices. The effects upon revenue and the sharing of burden incident to changes in the proportion of earnings distributed are analyzed. On the basis of a 73-company sample of Australian firms, inter-company comparisons of variations in dividend policy and their tax consequences are attempted. A negative conclusion is reached as to the possibility of selecting one from among the several Commonwealth company tax programs as preferable on grounds of pro-cyclical or counter-cyclical effects. Actual distributions of earnings by Australian companies are compared with the various standards of sufficiency which were employed, and tentative conclusions are drawn concerning the effect upon dividend policy of the tax on insufficient distributions.

**THE EXPLOITATION OF THE STEAMBOAT:  
THE CASE OF COLONEL JOHN STEVENS**

(Publication No. 2534)\*

Dorothy Gregg, Ph.D.  
Columbia University, 1951

The purpose of this study was to undertake an examination of a concrete instance of the process by which a given technological pattern has been incorporated into the structure of the business enterprise system. The primary concern was not with the development of the technology itself, but the steps whereby the technology was made commercially successful. Therefore, much attention was necessarily devoted to an investigation of business enterprise practices (its motives, aims, methods, and effects) as these impinged upon the

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utilization of a given technology. The steamboat was selected as the technology and Colonel John Stevens' exploitation of the steamboat as the specific case study. Other early steamboat entrepreneurs, such as John Fitch, James Rumsey, Oliver Evans, Nicholas Roosevelt, Robert Fulton, and Robert R. Livingston, appear in their proper roles, but the main attention is focused upon Colonel Stevens. Stevens' interest in the steamboat was a part of his general interest in developing transportation facilities, first in order to enhance the values of his real-estate holdings and second as profitable enterprises in themselves. For the purposes of this study, Stevens' interest in transportation will center on the steamboat around which revolved his related business interests.

The principal source used was the Stevens Collection, housed in the Stevens Institute of Technology at Hoboken, New Jersey, which contains over ten thousand original documents, most of which fall in the period between 1760 and 1830. The Livingston Collection and the Fulton Collection provide much additional information.

Chapter I presents the general historical background of the period from 1780 to 1830 in America, with an emphasis placed upon the technological developments in the field of transportation. Chapter II draws a sketch of Colonel John Stevens, the man, and how and why he became interested in the steamboat. Chapter III illustrates the steps which Colonel Stevens and the other major steamboat entrepreneurs took in order to appropriate the steamboat technology, such as ferreting out the innovations and then securing exclusive state grants and federal patents. Chapter IV depicts the business strategy of such steamboat entrepreneurs in the northeast as Stevens — the use of government and the courts to defend and acquire privileged positions, the importance of licensing agreements, and open guerrilla warfare between rivals — which culminated in Marshall's famous 1824 decision in the case of Gibbons versus Ogden. Chapter V gives an account of the business operation of the steamboat by Stevens and his fellow entrepreneurs, including a discussion of the forms of business organization, steamboat routes, sources of capital, expenses, sources of income, and profits and losses. Chapter VI shows the relationship between Stevens' steamboat ventures and such projects as roads, wharves, dry docks, stagecoaches, and navigation improvements, in order to build an integrated transportation system. Chapter VII outlines the alternatives which Stevens proposed when temporarily thwarted in his attempts to develop his steamboat ventures. This chapter also shows how one of Stevens' alternatives, the railroad, became the primary means of consolidating his transportation interests on land and water. Chapter VIII deals with Stevens' death and his financial and business achievements at the time of his death. Chapter IX, the conclusion, sums up the major points of significance to be drawn from this study.

Stevens is in many important respects the prototype for the early steamboat entrepreneur. And to some degree the early steamboat entrepreneur is the archtype of the "captain of industry" or "man-of-larger-affairs" of the early nineteenth century. Indeed, many of the steamboat entrepreneurs were active in various lines of business — some apparently unrelated to steamboating. Thus, in microcosm is unfolded a history of early nineteenth-century business practices, with the focus always on Colonel Stevens and the steamboat.

### DISTRIBUTION OF COSTS IN LIFE INSURANCE

(Publication No. 2554)\*

Oscar N. Serbein, Jr., Ph.D.  
Columbia University, 1951

This dissertation is a study of the changes in the structure of life insurance costs that have resulted from fundamental changes in investment income, mortality, and expenses. Considerable attention is given to the historical aspects of the problem and to the impact of the Guertin legislation.

The discussion is divided into eleven chapters. Chapter I defines the cost factors of life insurance and describes briefly how their magnitude is determined by insurers. Chapters II, III, and IV are devoted to a detailed discussion of the measurement of the cost factors with emphasis on current procedures and outlook. Chapter III contains a thorough discussion of the construction of the Commissioners' 1941 Standard Ordinary Table. Chapter V presents in detail procedures for computing life-insurance premiums for participating and non-participating contracts. Life insurance reserves are discussed in Chapter VI; a detailed discussion of the standard valuation law and of the Commissioners' Reserve Valuation method is presented. Chapter VII contains several tables that show how life-insurance premiums change as a result of absolute changes in the cost factors. Changes in the factors are considered singly and in combination.

Chapter VIII is concerned with the historical background of non-forfeiture benefits and with the adjusted-premium method of computation. A detailed analysis of the Standard Non-forfeiture law is also included. In Chapter IX an analysis of factors entering into dividend computation is made. The effects of changes in the

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cost factors on dividends are indicated. Chapter X contains a discussion of certain aspects of the mathematical theory of risk. The findings of the study are presented in Chapter XI.

The conclusions reached as a result of the research are best understood if divided into two parts: 1) the effects of the new standard valuation and non-forfeiture legislation on the cost of insurance and 2) the effects on insurance costs of changes in mortality, interest, and expense.

The effects of the new legislation on the cost of insurance may be summarized as follows:

1. Insurance in force before the passage of the new legislation was not affected. The new laws apply only to new business. Hence future effects are the important ones.

2. As far as participating contracts are concerned, if all insureds and all contracts are considered, there will be no overall effect on the cost of insurance. Cost is determined by actual mortality, actual investment income, and actual expense. These factors are not changed by legislation.

3. As far as nonparticipating contracts are concerned, if profits remain unchanged, there will be no overall effect on the cost of insurance. As in the case of participating contracts, cost is determined by experience.

4. There will be some changes in cost of individual contracts since larger non-forfeiture values mean smaller dividends. However, the net result of the changes will be a more equitable pattern of cost.

The changes that have occurred in the cost factors are of considerable importance. There has been a general decline in the rates of mortality of both the general population and the insured population. The decline has been greatest at ages under fifty. The rate of investment income earned by insurers has decreased for a number of years. Although a slight improvement has occurred recently, there is no indication that this upward trend will continue. General insurance expenses have increased, particularly since 1946. Assuming no changes in the other factors, the general result of increased expenses is to increase life-insurance premiums.

The simultaneous effects on the selling price of changes in the various cost factors depends on plan of insurance and age at issue. The general result has been that many insurers have increased premiums because the pattern of change was such that higher premiums were indicated.



THE DIELS-ALDER REACTION OF 1-VINYL-6-METHOXY-3,4-DIHYDRONAPHTHALENE WITH MALEIC ANHYDRIDE, MESACONIC ACID AND CITRACONIC ANHYDRIDE.  
THE CONFIGURATION OF THE C/D RING JUNCTURE OF THE ESTROGENIC HORMONES

(Publication No. 2580)\*

John Controulis, Ph.D.  
University of Michigan, 1950

The Diels-Alder reaction of 1-vinyl-6-methoxy-3,4-dihydronaphthalene with several different dienophiles has been studied in some detail. The general aim of this study was to secure compounds of known configuration which could be employed in the determination of the configuration of the C/D ring juncture of the estrogenic hormones. In addition, the compounds would be valuable precursors in the synthesis of the estrogenic hormones, estrone, estradiol, and equilenin.

In order to facilitate this study, an investigation of the known method of preparing the vinyl dihydronaphthalene from 6-methoxy-1-tetralone and the acetylene Grignard reagent was necessary. Although this synthesis had been accomplished by several other investigators, the procedure was not readily repeated. In the course of the reinvestigation, an analytical method for the determination of the acetylene Grignard reagent and a duplicable procedure for the preparation of 1-vinyl-6-methoxy-3,4-dihydronaphthalene were devised.

The known reaction of the diene with maleic anhydride was studied further and information was obtained about the position of the conjugated double bond in the adduct. A new series of isomeric derivatives were prepared by shifting the double bond to the B/C ring juncture. The structural conclusions were based on ultraviolet absorption spectra.

The new reaction of the diene with mesaconic acid was carried out and the resulting adducts were isolated and characterized through formation of several known derivatives. The adducts contained the carboxyl groups in the trans configuration.

The condensation of 1-vinyl-6-methoxy-3,4-dihydronaphthalene with citraconic anhydride was investigated further and some new structural relationships were established on the basis of ultraviolet absorption spectra. The position of the conjugated double bond in

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the adducts and derivatives was clearly indicated. The adducts were readily dehydrogenated to the corresponding tetrahydro compounds which contain a naphthalene ring. The two possible acid esters were prepared from the dimethyl ester of cis-2-methyl-7-methoxy-1,2,3,4-tetrahydrophenanthrene-1,2-dicarboxylic acid and were subjected to Arndt-Eistert syntheses. The next higher homolog of one of these cis acid esters proved to be identical with a compound which is an intermediate in the synthesis of isoequilenin. This identity establishes the configuration of the C/D ring juncture in isoequilenin as cis, since apparently the rearrangement in the Arndt-Eistert synthesis does not involve an inversion. Because of known stereochemical relationships of isoequilenin and equilenin, the latter must possess the trans configuration at the same juncture. Similarly, estrone and estradiol, having the equilenin configuration in the C and D rings, must also be trans. The result also represents a synthesis of isoequilenin via the Diels-Alder reaction.

#### PARTICLE FORMATION AND STABILITY IN COLLOIDAL SYSTEMS

(Publication No. 2531)\*

Robert Hudson Dinegar, Ph.D.  
Columbia University, 1951

##### Part I: Theory, Production and Mechanism of Formation of Monodispersed Hydrosols

Monodispersed colloids exhibiting higher order Tyndall spectra have been prepared by precipitation of sulfur from ethanol and acetone solutions by the addition of water. The relationship between the concentration of sulfur and the volume fraction of water at the critical point of sulfur ethanol-water solutions has been investigated. These sols have been investigated as to dispersion of wave length in their angular scattering of visible light and their transmission as a function of wave length. The growth rates of these sols have been reproduced from previous theoretical considerations which allow the estimation of the value of the diffusion coefficient of  $S_8$  in alcohol-water and acetone-water mixtures. The value of this diffusion coefficient lies in the range  $7 - 8 \times 10^{-6} \text{ cm}^2/\text{sec.}$  for both media.

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## Part II: Kinetics of the Acid Decomposition of Sodium Thiosulfate

The kinetics of the acid decomposition of sodium thiosulfate in dilute solution has been reinvestigated spectrophotometrically.

Measurements made at  $\lambda = 4000 \text{ \AA}$  show that the time of appearance of discrete particles of colloidal sulfur depends approximately on  $(\text{H}^+)_0^{1/2}$  and  $(\text{S}_2\text{O}_3^{2-})_0^{>1}$ . The resultant data has been analyzed in conjunction with the facts that the decomposition shows a positive Bronsted primary salt effect and that thiosulfuric acid is not completely dissociated with respect to its second ionization. By assumption of a bimolecular mechanism between  $\text{HS}_2\text{O}_3^-$  and  $\text{S}_2\text{O}_3^{2-}$  with an intermediate complex whose first order specific rate constant ( $k_2$ ) is comparable to the bimolecular specific rate constant ( $k_1$ ) kinetic equations have been derived that express the experimental results reasonably well. The value of  $k_1$  and  $k_2$  calculated are .31 and .14 respectively. Only sulfite ion is produced in significant amounts in the early stages of the decomposition in dilute solutions.

## Part III: Stability of Monodispersed Sulfur Hydrosols

Monodispersed sulfur hydrosols prepared by the acid decomposition of sodium thiosulfate have been shown to obey Beer's Law of dilution at wave lengths where both scattering plus absorption and where scattering alone occurs. These sols are relatively stable and show practically no tendency to coagulate due to the small number of particles (ca  $1-3 \times 10^6/\text{cc}$ ), but have marked instability with a tendency to redissolve when the pH is more alkaline than 4. The rate of this dissolving has been studied as a function of the pH of the solution and the data indicate a Langmuir type of adsorption of  $\text{SO}_3^{2-}$  on sulfur with a resulting reaction and removal of S from the particle surface probably reversal to  $\text{S}_2\text{O}_3^{2-}$ . The equilibrium constant for the reaction



has been estimated as 210.

## Part IV: The Limiting Degrees of Supersaturation of the Sparingly Soluble Sulfates

The maximum limiting concentrations of sulfate ion that can coexist in aqueous solution with barium and strontium ions, respectively, without producing rapid visible precipitation detectable by Tyndall beam, have been investigated for a variety of conditions. To avoid the possibility of local inhomogeneities in concentration as a result of the direct mixing of reagents leading to premature nucleation, sulfate has been generated homogeneously by chemical

reactions in the presence of the cations. The data are interpreted in terms of the ratio of the observed mean ion product at the limiting supersaturation  $(K_{ss})^{1/2}$  to the corresponding value  $(K_{SP})^{1/2}$  at saturation in respect to the stable crystalline phase; i. e., to  $(K_{ss}/K_{SP})^{1/2}$ . These ratios are sensitive to ionic environment and consequently require correction to unit values of the activity coefficient. The uncorrected ratio for barium sulfate varies from 48 to 55; when corrected to unit activity coefficient the ratio assumes a constant value of 21.5. The ratio decreases with rising temperature. The technique of direct mixing of reagents gives limiting supersaturation values which decrease uniformly with the elapsed time required for the appearance of the Tyndall beam. When extrapolated to an elapsed time of zero, the corrected ratio becomes 21.2. The corrected ratio for strontium sulfate is 2.9.

### THE CHEMISTRY OF N-ACETYLPHTHALIMIDES

(Publication No. 2674)\*

Manuel Felix Drumm, Ph.D.  
University of Missouri, 1951

Little is known about the chemistry of N-acylphthalimides; and that relative to N-acetylphthalimides is particularly obscure. Only superficial studies have been made and these were confined to hydrolysis and pyrolysis products. No N-acetyl derivative of a ring-substituted phthalimide has heretofore been synthesized.

N-Acetylphthalimides may be prepared by refluxing the imide with an excess of acetic anhydride. In this manner, the N-acetyl derivatives of phthalimide, 3- and 4-nitro-, 3- and 4-bromo- and 3- and 4-methylphthalimides have been formed.

This class of compounds has limited solubility in cold solvents, particularly water, ether and petroleum ethers. They are quite soluble in polar solvents such as acetone and dioxane, and are soluble in most organic solvents when hot. All are solids with melting points ranging from 127-152°.

N-Acetylphthalimides will acetylate n-butyl alcohol both at room and elevated temperatures. This acetylation was accomplished in the presence of sodium n-butoxide, but failed with p-toluenesulfonic acid or in the absence of a catalyst.

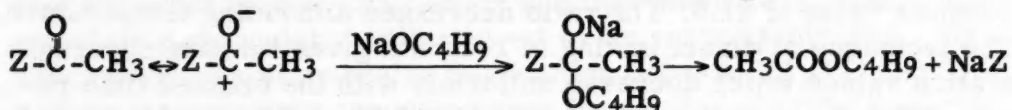
The relative order of reactivity of these compounds was determined under controlled temperature conditions. Both at room

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temperature and at the reflux temperature of the reaction mixtures, the order of increasing activity was found to be as follows: 3-nitro-, 4-nitro, 3-bromo-, 4-bromo-, unsubstituted, 3-methyl- and 4-methyl-N-acetylphthalimide.

This acetylation is thought to proceed by a mechanism involving a resonance form of the N-acetylimide which results in the formation of n-butyl acetate and the sodium salt of the imide. If the phthalimido group is replaced by "Z," the following equation is obtained;



The sodium salt then reacts with the excess of alcohol to form the imide and sodium n-butoxide.

This mechanism was indicated by the fact that the relative acetylating ability of these compounds was found to be in exact reverse to the order of increasing acid strength of the imides from which the acetylating agents were derived. Measurements of the ionization constants of the imides revealed that those N-acetylphthalimides which are derived from imides of relatively high acid strength are those which are the least reactive toward n-butyl alcohol. This relationship was confirmed theoretically by a consideration of the resonance and inductive effects of the substituents relative to the imide system, and it was evident that the same influences which increased the acid strengths of the imides, decreased the activity of the nitrogen-acetyl bond toward sodium n-butoxide.

N-Acetylphthalimide will react with phenylmagnesium bromide to give 3-phenyl-3-hydroxyphthalimidine, diphenylmethylcarbinol and o-dibenzoylbenzene. In the Grignard machine, however, it shows the presence of one active hydrogen per mole and it adds from 2-3 moles of the Grignard reagent.

Reduction of the compound with lithium aluminum hydride gave N-ethylidihydroisindole. Reduction by means of the common low pressure methods failed as did high pressure reduction over copper chromite catalyst.

n-Butylamine will react with N-acetylphthalimide to produce N,N'-di-n-butylphthalamide.

N-Acetylphthalimide did not condense with benzaldehyde in the presence of triethylamine or dimethylaniline, although large amounts of phthalimide were formed during the reaction period.

Further investigation of the mechanism of the acetylation reaction is indicated and the reaction should be attempted with the use of other catalysts. Under proper conditions, lithium aluminum hydride might reduce selectively the three amido groups of N-acetylphthalimide. High pressure reduction should be repeated with the use of more efficacious catalysts. Condensations involving the



methyl hydrogens of N-acetylphthalimide might be affected by the proper combination of catalyst and condensing agent. The reaction of the N-acetyl compounds with organo-lithium compounds would be of particular interest.

## THE PREPARATION OF SUBSTITUTED AMINO DICARBAMATES

(Publication No. 2675)\*

Walter Lester Dunkel, Ph.D.  
University of Missouri, 1951

The use of urethans in the field of pharmacology is well known. Little work has been done, however, in relation to the diurethans obtained from aliphatic dichlorocarbonates and aliphatic, aromatic and heterocyclic amino compounds.

By causing ethylene dichlorocarbonate to react with *p*-aminodimethylaniline there was obtained a good yield of *N,N'*-di-(*p*-dimethylaminophenyl)ethylene dicarbamate dihydrochloride. Similar compounds were also prepared in which the tertiary amino group was in the *ortho* or *meta* positions.

Attempts to condense Tetracaine ( $\beta$ -dimethylaminoethyl *p*-*n*-butylaminobenzoate) with a dichlorocarbonate proved to be futile. However, a series of substituted dicarbamates was obtained from *n*-butylaniline and various dichlorocarbonates. These products are viscous, non-distillable oils, with the exception of the tetramethylene derivative which is a low melting, white solid. No condensation could be affected between ethyl *p*-*n*-butylaminobenzoate and ethylene dichlorocarbonate.

A series of dicarbamate derivatives of 2-aminopyridine has been prepared. These compounds are all well defined white amorphous solids. The hydrochloride salts of these compounds are only very slightly soluble in water.

Other heterocyclic diurethans prepared were *N,N'*-di-(2-benzothiazyl)ethylene dicarbamate dihydrochloride, *N,N'*-di-(2-thiazyl)ethylene dicarbamate dihydrochloride, *N,N'*-di-(1-benzimidazolyl)tetramethylene dicarbamate dihydrochloride and *N,N'*-di-1-(2-methylbenzimidazolyl)-ethylene dicarbamate.

Two new barbital derivatives were prepared by condensing sodium barbital and ethyl chloroformate by the use of an excess of ethyl chloroformate as the solvent. Both the *N*-carboethoxy and the

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N,N'-dicarboethoxy derivatives were obtained, but the yield of the latter was comparatively low. All attempts to condense sodium barbital with a dichlorocarbonate to obtain the bis derivative failed. The same results were obtained when the potassium salt of barbital was used.

Since many of the compounds were related to the amidines the work was extended into this field by condensing a group of amidines with the various dichlorocarbonates in the presence of a strong base. The yield of the N,N'-diamido diurethans was exceptionally high; seventy to ninety percent.

When dichlorocarbonates were treated with aliphatic straight chain diamines, such as diethylaminoethylamine and diethylamino-propylamine, there was obtained a series of very viscous oils. Since it was not possible to obtain them in a satisfactory state of purity they were not identified further.

Pharmacological data are incomplete at the present time and consequently no statement may be made in regard to the physiological properties of these compounds.

### POLYPHENYL

(Publication No. 2564)\*

Gerald Alonzo Edwards, Ph.D.  
University of Buffalo, 1951

The literature on polymeric systems being deficient with regard to the study of rigid, rod-like molecules, a project was undertaken to prepare and study the properties of a polymeric substance of this type.

This substance, identified as para-polyphenyl, was prepared by the condensation of para-dichlorobenzene in dioxane solution by a liquid potassium-sodium alloy. One portion of the reaction mixture obtained in yields of 25%-50% of the theoretical is soluble in benzene but insoluble in a 1:2 benzene-methanol solution. This material is a tan-brown powder which does not melt on being heated to 550° C. It is soluble in pyridine, chloroform, aromatic hydrocarbons, and molten camphor, but it is insoluble in aliphatic hydrocarbons and the more polar organic solvents.

Cryoscopic molecular weight determinations in benzene containing 0.2 to 1.0 g. of polyphenyl per 100 g. of benzene gave values of 2,700 to 2,800, the error being  $\pm 100$  to  $\pm 500$ , depending on the

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concentration. Essentially the same value was obtained using other solvents such as pyridine and camphor at various temperatures. Chlorine analysis showed  $4.9 \pm 0.9$  chlorine atoms per molecule. Hence, the degree of polymerization is approximately 34 six membered carbon-ring units, some of which may be substituted meta to the chain. Its ultra-violet absorption spectrum shows a maximum at around  $3,000 \text{ \AA}$ . The position of this absorption maximum suggests a predominantly quinoid arrangement. Although X-ray diffraction photographs of polyphenyl show the diffuse rings characteristic of an amorphous solid, some evidence of orientation is indicated by the variable birefringence shown by slowly dried samples.

In extremely dilute solutions, the specific viscosity divided by the concentration in grams of polyphenyl per 100 ml. of benzene solution passes through a maximum with increasing concentration reaching a constant value at a concentration of about 1 g./100 ml. The value of the specific viscosity divided by concentration at a given concentration decreases with increasing rate of shear. In the region of the maximum this effect is greatest, while at higher concentrations the effect of the rate of shear becomes negligible.

This behavior is a manifestation of two opposing tendencies: the one, the tendency of the rod-like molecules to align at high rates of shear and at relatively high concentrations; the other, the tendency of the molecules to move at random in solution.

Particles of polyphenyl precipitated from benzene solution by the addition of methanol are attracted by the poles of a magnet. It was observed that a magnetic field normal to the capillary of an Ostwald viscosity pipette increases the viscosity of polyphenyl solutions. It is assumed that the polyphenyl molecules tend to align themselves like compass needles parallel to the field, thus, disturbing the alignment parallel to the direction of flow. The increase in the disorder of the solute increases the viscosity of the solution.

# N-MONO-SUBSTITUTED ETHYLENEDIAMINE COMPLEXES OF COBALT AND NICKEL

(Publication No. 2586)\*

Lawrence John Edwards, Ph. D.  
University of Michigan, 1950

Since most of the available information on coordination compounds is primarily concerned with the central metal ion, the purpose of this investigation was to attempt to carry out reactions on the coordinated groups of complexes and to ascertain, if possible, how the reactivity of the ligand is changed by coordination to a metal ion. Cobaltic complexes of N-hydroxyethylethylenediamine,  $\text{NH}_2\text{CH}_2\text{CH}_2\text{NHCH}_2\text{CH}_2\text{OH}$ , and N-(2-hydroxypropyl)ethylenediamine,  $\text{NH}_2\text{CH}_2\text{CH}_2\text{NHCH}_2\text{CH}(\text{OH})\text{CH}_3$ , were prepared. In these tris-diamine cobaltic complexes the diamine molecules are presumably coordinated to the metal ion through the nitrogen atoms and this should, therefore, make the alcoholic hydroxyl groups of each diamine molecule available for reaction. Both esterification and replacement reactions were attempted by treating samples of the complexes with acetyl chloride, benzoyl chloride, acetic anhydride, thionyl chloride, concentrated nitric acid, and hydrobromic acid. In spite of the fact that no reactions could be observed with these reagents, it seemed quite significant that these complexes possess remarkable stability toward decomposition.

Because of this extreme stability, measurements were made to obtain more quantitative information regarding the relative stabilities of both cobaltous and nickel complexes with a large series of diamines including, N-hydroxyethylethylenediamine, N-(2-hydroxypropyl)ethylenediamine, N-(3-hydroxypropyl)ethylenediamine, N-methylethylenediamine, N-ethylethylenediamine, ethylenediamine, propylenediamine, and 1,3-diaminoisopropanol. The method selected for this study involved pH determinations by means of a hydrogen electrode during a potentiometric titration of an acidic metal salt solution with the diamine. To perform the calculations for the cobaltous or nickel diamine systems, it was necessary to determine the two dissociation constants for the acid diamine ions. This was done by an entirely analogous set of titrations on acidic salt solutions in which the cobaltous or nickel ions were replaced with barium chloride (i. e., a non complex-forming salt). All measurements were made at 25° C. in 1 N KCl. The equilibrium

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constants (referred to as "formation" constants) for the stepwise formation of the metalammine complexes in the solution were obtained by combining the diammonium dissociation constants with the pH measurements from the titration step in accordance with the appropriate mass action expressions. From the calculated results, it is possible to construct a "formation curve" which represents the formation of the various complex species throughout the titration.

The formation curves for cobaltous and nickel ions with ethylene diamine show a gradual increase in the average number of diamine molecules coordinated until a maximum of three is reached. However, with these metal ions and both N-hydroxyethylethylenediamine and N-(2-hydroxypropyl)ethylenediamine the bis-complexes were shown to predominate in aqueous solution while no evidence was obtained for the formation of the tris-complexes. The bis-complexes of N-(3-hydroxypropyl)ethylenediamine also predominate over a range of diamine concentration but finally the tris-complexes are formed at higher diamine concentrations. All attempts to prepare solid bis-derivatives of these diamines were unsuccessful but the tris-complex was obtained in each case.

Redox potentials of the cobalt (II-III) systems with ethylenediamine and N-hydroxyethylethylenediamine were measured by two methods involving potentiometric titrations. These redox potentials combined with the previously determined formation constants permit calculation of the equilibrium constants for the cobaltic complexes.

#### A STUDY OF THE HOFMANN DECOMPOSITION OF QUATERNARY AMMONIUM HYDROXIDES

(Publication No. 2593)\*

Simon Frank, Ph.D.  
University of Michigan, 1951

A series of quaternary ammonium hydroxides of the general formula  $(R-CH_2CH_2)_2\overset{+}{N}(-CH_2CH_2-R')_2 OH^-$  has been prepared and submitted to the Hofmann degradation. The precise determination of the composition of the resulting olefin mixture was accomplished by use of the mass spectrometer as the analytical tool. R and R' were so chosen that the results obtained could be used to compare

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the effect of the groups hydrogen, methyl, ethyl, isopropyl, and t-butyl as  $\beta$  substituents on the course of the decomposition. Of the two olefins produced, decomposition generally led to the preferential formation of that olefin with a lower molecular weight as required by the Hofmann rule. Interpretation of the results in terms of the inductive release due to the  $\beta$ -substituent gave the following quantitative values: hydrogen 1, methyl 16, ethyl 32, isopropyl 64, t-butyl 640.

The case where R is phenyl and R' is hydrogen was reexamined and the results verified Hanhart and Ingold's conclusion that styrene is the only olefinic product. Decomposition of hydroxides of the type  $(R-CH_2CH_2)_x\overset{+}{N}(CH_2CH_2-R')_y, OH^-$  where x is 1 or 3 and  $x + y = 4$ , established the fact that a statistical factor operates in addition to the electronic effects.

Decomposition of hydroxides of the type  $R-\overset{+}{N}Me_3, OH^-$  led to results which established the ease of elimination as olefins of the following groups (relative to ethyl = 100): n-propyl 83, n-butyl 86, isoamyl 78, homoneopentyl 20. The sharp drop in the last case is considered to indicate the appearance of a steric factor in highly branched groups.

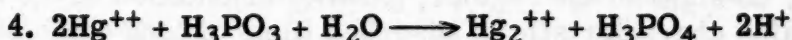
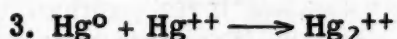
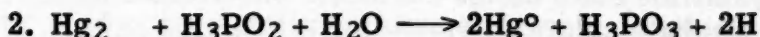
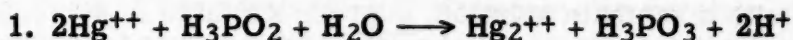
The properties of the groups considered from the results of the decompositions are discussed and compared with data taken from the literature on the strength of aliphatic acids, the basic strength of alkyl amines, the properties of alkyl benzenes, and the behavior of alkyl groups in the Beckmann and pinacol rearrangements. In general, the qualitative correlations which have been the subject of speculation in the literature are confirmed. The lack of quantitative agreement demonstrates that the foregoing properties are each the resultant of several factors, of which the inductive effect of alkyl groups is not always dominant.

A KINETIC STUDY OF THE REACTION BETWEEN  
MERCURIC NITRATE AND HYPOPHOSPHOROUS ACID

(Publication No. 2678)\*

Charles Otto Gerfen, Ph.D.  
University of Missouri, 1951

A study of the kinetics of the reaction between hypophosphorous acid and mercuric ion has been made. When the proper concentration of hypophosphorous acid is added to a mercuric nitrate solution no apparent reduction of mercuric ion is noticed for several minutes; however, after a lapse of time, finely divided mercury suddenly appears throughout the entire solution. It is quite striking in its manner of appearance. The kinetics were studied by measuring the rate of disappearance of mercuric ion. The mercuric ion concentration was followed by measuring the E.M.F. between mercurous-mercuric and mercury-mercurous electrodes dipping into the reaction mixture. The concentrations were adjusted so that the time of the overall reaction varied between two minutes and thirty minutes. Rates of reaction were determined from plots of time versus mercuric ion concentration and the rates were found to be explainable by four concurrent reactions. The following mechanism for the overall reaction is proposed.



Reactions 2, 3, and 4 were run separately and their rates measured. The overall rate has been analyzed into component parts and these rates are consistent with the above reactions which were observed separately.

The reaction was run at 0° and 25°. The rate constants for Reaction 1, at these temperatures, were 1.42 and 11.42 liters per mole-minute, respectively. The activation energy of the process involved 13,600 calories. The temperature coefficient for Reaction 1 was found to be 8.04 for 25°. Logarithmic proportion reduces this to 2.20 for 10°.

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AN ELECTRON DIFFRACTION INVESTIGATION OF SURFACE  
REACTIONS IN THE FLOTATION SEPARATION  
OF SULFIDE MINERALS

(Publication No. 2596)\*

Robert James Good, Ph.D.  
University of Michigan, 1950

When sphalerite ( $\text{ZnS}$ ) is activated by copper sulphate solutions toward flotation by xanthates,  $\text{CuS}$  is deposited on the surface. If the aqueous solution is alkaline enough to show a fine suspended precipitate of  $\text{Cu}(\text{OH})_2$ , the surface of sphalerite treated in this solution gives the electron diffraction pattern of covellite ( $\text{CuS}$ ). If the copper sulphate solution is sufficiently acid to keep all of the copper in solution, the sphalerite surface treated in the solution gives the electron diffraction pattern of  $\text{CuS}$  only if the treatment is followed by etching of the surface with  $\text{HCl}$ . Indirect evidence is adduced for the occurrence of the  $\text{CuS}$  in solid solution at the surface of the sphalerite before etching with acid.

The activation of sphalerite by lead acetate solutions, and of cerussite ( $\text{PbCO}_3$ ) by sodium sulfide solutions are accompanied by the formation of  $\text{PbS}$  in a crystalline phase on the surfaces.

When the mineral covellite ( $\text{CuS}$ ) or  $\text{CuSO}_4$ -activated sphalerite is treated with a xanthate solution, cuprous xanthate is deposited in the microcrystalline state on the surface. Unactivated sphalerite treated with xanthate solutions yields the diffraction pattern of crystalline zinc xanthate. The diffraction patterns of the xanthate show practically no signs of the regular, parallel orientation of the hydrocarbon chains characteristic of adsorbed films of long chain fatty acids. The degree of preferred orientation of the crystals in the films varies with the xanthate chain length and with the cation in the xanthate.

Qualitative observations on the wetting properties of the mineral surfaces treated in various ways lead to a correlation of the observations on contact angles observed by Wark and other workers in the field of flotation. The contact angles on treated mineral surfaces discussed in the literature are those due to a polycrystalline layer of a metal xanthate; contradictions previously reported are shown to arise from the incorrect assumption that the xanthate films are regularly oriented monolayers in all experiments. It is concluded that the "depressant" effect of hydroxyl ion in

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inhibiting mineral flotation is due to the prevention of the precipitation of the metal xanthate.

Some anomalous displacements toward small radii of diffraction rings of ZnS were observed from specimens which were wiped after grinding on emery paper. Refraction of the electrons due to the inner potential of the crystal was considered as a possible cause of the displacement. This led to the application of new general formulas for the effect of refraction by any pair of crystal faces in any orientation on electrons diffracted by any crystallographic plane. Calculated displacements are in approximate agreement with those observed. The discrepancies are thought to be due to incorrect assumptions about the surface contour or about the value of the inner potential in sphalerite.

#### SYNTHESIS OF COMPOUNDS RELATED TO DIALKYLAMINOALKYL p-AMINO BENZOATES

(Publication No. 2682)\*

Thomas Robert Hopkins, Ph.D.  
University of Missouri, 1951

Although the local anesthetic procaine is employed widely in medicine, it is not considered to be an ideal drug. Procaine suffers from at least two outstanding limitations: its duration of action is relatively short, and it has a tendency to cause convulsions if administered at levels greater than a patient can tolerate. In spite of the numerous modifications that have been made in the basic structure associated with procaine, these defects apparently have not been overcome.

It is known that if an hypnotic is injected simultaneously with, or preceeding, the administration of procaine, the effect and duration of the anesthesia will be increased. This investigation was undertaken to incorporate a urethan linkage (which has a mild hypnotic effect in many cases) into a procaine molecule. The compounds resulting from this union have been assigned the arbitrary names of "urecaine" or "diurecaine," depending upon whether a mono- or diurethan was formed.

A series of dichlorocarbonates was prepared by the interaction of phosgene with various glycols. Three different methods of synthesizing these dichlorocarbonates were employed. Two glycols,

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1,4-cyclohexanediol and 2,4-dihydroxy-4-methylpentane gave unexpected products when treated with phosgene.

The dichlorocarbonates were identified by preparing the diurethan derivatives which were all high melting crystalline solids. Three diurethans presenting a reversed linkage from those derived from the dichlorocarbonates were made through the Bianchi reaction or the direct condensation of a chlorocarbonate and a diamine. These diurethans were ethylene bis- $N,N'$ -( $\beta$ -chloroethyl urethan), propylene bis- $N,N'$ -( $\beta$ -chloroethyl urethan) and methylene bis- $N,N'$ -( $\beta$ -chloroethyl urethan).

Procaine was condensed with the dichlorocarbonates giving bis- compounds (diurecaines). The diurecaines are, in general, white solids except when derived from branched chain dichlorocarbonates, which yield viscous oils. The dihydrochlorides, dioxalates, dipicrates, disalicylates, didiliturates, and dichloroplatinates were employed as derivatives of the diurecaines. Two dichlorocarbonates, 1,4-cis-cyclohexenyl dichlorocarbonate and 2,3,5,6-tetrachloro-*p*-phenylene dichlorocarbonate failed to react with procaine.

An attempt to find the physiologically active portion of the diurecaine molecule led to the elimination of (or substitution in) various functional groups. The synthesis of the following compounds has been described:  $N,N'$ -di-(*p*-carboxyphenyl)-tetramethylene diurethan;  $N,N'$ -dicarboxymethyltetramethylene diurethan; the diacid chloride and the diamide of  $N,N'$ -dicarboxymethyltetramethylene diurethan;  $N,N'$ -diphenyltetramethylene diurethan;  $N,N,N',N'$ -tetraethyltetramethylene diurethan;  $\beta$ -hydroxy- $N,N$ -diethyl-*n*-propylamine;  $N,N'$ -di-[*p*-( $\alpha$ -methyl- $\beta$ -diethylamino)-carboethoxyphenyl]-tetramethylene diurethan dihydrochloride; bis-( $\beta$ -diethylamino)-ethyl carbonate;  $N,N'$ -diethyl-*p*-nitrophenylacetamide; 4,4'-di-( $\beta$ -diethylethyl)-azobenzene; 4,4'-dihydroxymethylazobenzene; *p*-aminophenylacetoneitrile;  $\beta$ ,  $\beta$ -di-(*p*-acetylaminophenyl)-diethylamine; *p*-cyanomethylacetanilide;  $\beta$ -phenyl- $N,N$ -diethylethylamine;  $\beta$ -(*p*-nitrophenyl)- $N,N$ -diethylethylamine;  $\beta$ -(*p*-aminophenyl)- $N,N$ -diethylethylamine;  $N,N'$ -di-(*p*-diethylaminoethylphenyl)-tetramethylene diurethan;  $\beta$ -diethylaminoacetoneitrile,  $N,N$ -diethylethylenediamine;  $N,N$ -diethyl- $N'$ -(*p*-nitrobenzoyl)-ethylenediamine;  $N,N$ -diethyl- $N'$ -(*p*-aminobenzoyl)-ethylenediamine;  $N,N'$ -di-(*p*- $\beta$ -diethylaminoethylcarbamidophenyl)-tetramethylene diurethan; methyl 6-nitro-1,2-benzisoxazole-3-carboxylate; *p*-nitrosalicylic acid; *p*-nitrosalicyl chloride; 4-nitro-2-hydroxytoluene; 4-nitro-2-methoxytoluene; 4-nitro-2-methoxybenzoic acid; 4-nitro-2-methoxybenzoyl chloride;  $\beta$ -diethylaminoethyl *p*-nitro-*o*-methoxybenzoate;  $\beta$ -diethylaminoethyl *p*-amino-*o*-methoxybenzoate;  $N,N'$ -di-[*p*-( $\beta$ -diethylaminoethyl)-*o*-methoxyphenyl]-tetramethylene diurethan;  $N,N'$ -di-(*p*- $\beta$ -diethylaminocarboethoxyphenyl) urea; and tetramethylene-bis- $\beta$ -diethylaminoethyl carbonate.



The pharmacology of several of the above compounds has been reported. A limited discussion on the essential linkages and groups necessary for physiological activity as a local anesthetic has been presented.

### THE DETONATION OF OZONE

(Publication No. 2683)\*

Stanley Arthur Hoshowsky, Ph.D.  
University of Missouri, 1951

Upon ignition of a combustible gas in a tube, under certain conditions, the flame may pass discontinuously into a detonation wave traveling at many times the speed of sound. There is a sharp discontinuity between the unreacted gas which remains undisturbed and the burning gas behind the wave front. The detonation wave has been successfully treated by a theory due to Chapman and Jouget which originated in the Hugoniot theory for shock waves. Recently the detonation theory has been extended by von Neumann. It was the purpose of this work to investigate the detonation of ozone and to compare the results with the theoretical predictions.

The detonation velocities and pressures were measured in ozone-oxygen mixtures by means of piezoelectric gauges in conjunction with a cathode-ray oscilloscope when the concentration of ozone was varied from 9.2 to 77 mole percent. The velocities were lower than the theoretical values calculated from the Chapman-Jouget theory but the maximum deviation did not exceed 5 percent. At least part of this deviation could be accounted for by heat losses. The detonation pressures were found to be lower than the theoretical values but the deviation from theory was in general, not greater than 10 percent. The theoretical pressures were calculated for the point where the reaction had attained equilibrium in the detonation wave.

According to the detonation theory as extended by von Neumann, the head of a detonation wave is a shock wave followed by a reaction zone in which the pressure decreases as the reaction proceeds to equilibrium. The reaction zone is apparently quite narrow, and there are practical difficulties which prevent a complete resolution of the pressure contour in this region; however evidence was obtained for the existence of a narrow zone of high pressure at the

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wave front as predicted by von Neumann, and it appeared to be partially resolved in certain cases in the detonation of ozone.

The phenomenon of spinning detonation was observed in the detonation of ozone. Previous workers have explained this type of detonation as a luminous head near the front of a detonation wave which rotated around the periphery of the tube in an helical path as the detonation proceeded along the tube. In this work, spinning detonation was found to have associated with it a periodic variation in pressure behind the wave front whose frequency and amplitude decreased slowly with the distance behind the front. Spinning detonation was predominant when the concentration of ozone was low.

#### THE STUDY OF THE REACTION OF CERTAIN ORTHOESTERS WITH VARIOUS AROMATIC ACID CHLORIDES

(Publication No. 2565)\*

Salvatore Maira, Ph.D.  
University of Buffalo, 1951

Ethyl, propyl, butyl and amyl orthoformates were reacted with benzoyl, p-nitrobenzoyl and p-chlorobenzoyl chlorides. For the reactions of the last three-named orthoformates with the various acid chlorides the reaction products were identified as the alkyl ester of the corresponding aromatic acid, the alkyl formate and the alkyl chloride. For the reaction of ethyl orthoformate with each of the acid chlorides only the corresponding, substituted ethyl benzoate and ethyl formate were identified. The percentage yields of the aromatic esters were determined. The yields were found to diminish as the size of the alkyl group increased.

Both ethyl orthoformate and ethyl orthoacetate were reacted with the following: m-nitro-, p-nitro-, 3,5-dinitro-, p-chloro-, m-chloro-, p-ethoxybenzoyl chlorides and benzoyl chloride. With each acid chloride, ethyl orthoformate was found to give a larger yield of the aromatic ethyl ester than ethyl orthoacetate.

Ethyl orthothioformate was found to react with benzoyl bromide. From the identification of the reaction products a mechanism for dithioester formation was proposed. By analogy, it was suggested that carbonyl compounds react with orthoesters through the medium of preliminary addition.

Halogen derivatives of hydrocarbons were found not to react with orthoesters.

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Compounds prepared not previously mentioned in the literature were: propyl, butyl and amyl p-chlorobenzoates.

A table of physical data appears at the end of the dissertation.

THE ABSORPTION SPECTRA OF SOME  
P-ACYLAMINO BENZENEDIAZONIUM  
SALTS AND DOUBLE SALTS

(Publication No. 2621)\*

Bernard Manning, Ph.D.  
University of Michigan, 1950

The primary object of this investigation was to obtain spectrographic data which would, by comparison with the ultra-violet absorption spectra of compounds of known structure, elucidate the structure of the p-acylaminobenzenediazonium salts and assist in the explanation of their color and unusual stability. The effects on the absorption spectra of these salts caused by: a) varying the acidity of the solvent, b) conversion to the double salt, c) substitution of various acyl groups on the para amino group of p-aminobenzenediazonium chloride, and d) position of substitution of one and two chlorine atoms ortho and meta to the diazonium group were also determined.

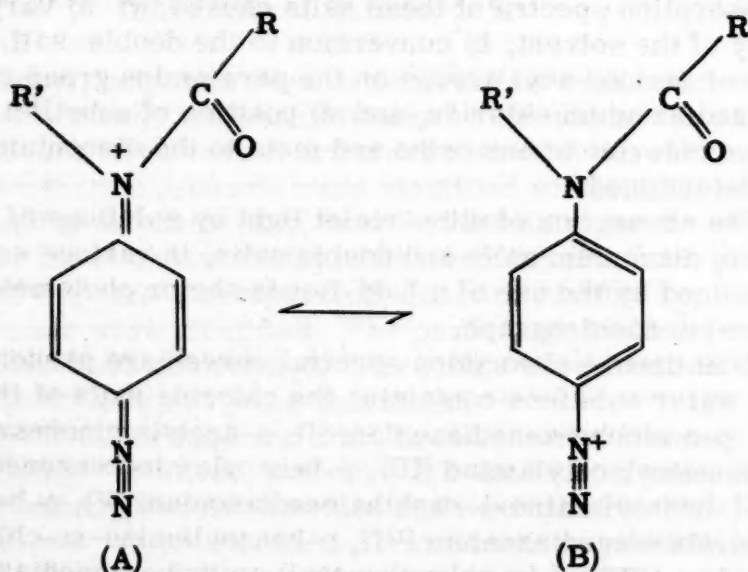
The absorption of ultra-violet light by solutions of the various amines, diazonium salts and double salts, in various solvents, was determined by the use of a Judd-Lewis sector photometer and a Hilger quartz spectrograph.

Quantitative absorption spectral curves are presented for distilled water solutions containing the chloride salts of the following ions: p-aminobenzenediazonium (I), p-acetylaminobenzenediazonium (II), p-methylacetyl amino (III), p-benzoylaminobenzenediazonium (IV), 4-benzoylamino-1-naphthalenediazonium (V), p-benzoylamino-o-chlorobenzenediazonium (VI), p-benzoylamino-m-chlorobenzene-diazonium (VII), p-(p-chlorobenzoyl) aminobenzenediazonium (VIII), p-(o-chlorobenzoyl)aminobenzenediazonium (IX), 2,6-dichloro-4-acetylaminobenzenediazonium (X), and 3,5-dichloro-4-acetylaminobenzenediazonium (XI); the antimonous chloride double salts of II and III and zinc chloride double salt of IV in various concentrations of hydrochloric acid; acetyl-1,4-benzenediazoimide (XII), benzoyl-1,4-benzenediazoimide (XIII), and benzoyl-1,4-naphthalenediazoimide (XIV) in various solvents; and the amines from which compounds I

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to XIV were prepared. The absorption spectra of the diazonium salts I-XI (with the exception of V) have a very similar appearance which is little affected by variation of acyl groups. The spectra of the amines are markedly affected by these acyl groups and differ from the diazonium salts and from one another. The spectra of the double salts, with the exception of the absorption due to the anti-mony, are identical to those of the diazonium salt in the same concentration of acid. The spectra of the diazonium salts in dilute acid were found to be almost identical to those of the salts in distilled water, while concentrated hydrochloric acid caused only a very slight shift of the bands toward the visible.

Comparison of the spectra of the diazonium salts with the spectra of p-benzoquinone, XII, fuchsone, XIII, and the diazoimides, XIV, reveals striking similarities and it is concluded that the electronic structures of the p-acylaminobenzenediazonium salts are predominantly quinonoid. The resonance hybrid which represents the structure is therefore best described by the forms A and B below with form A as the major contributor.



Substitution of one or two chlorine atoms ortho to the diazonium group increases the stability of these diazonium salts and shifts the long wave branch of the spectra toward the visible. One or two chlorine atoms meta to the diazonium group decreases the stability and causes a shift of the long wave spectral branch toward the shorter wave lengths. Chlorine atoms in the p-benzoyl group are without effect.



## DETONATION LIMITS IN HYDROGEN MIXTURES

(Publication No. 2690)\*

Ara John Mooradian, Ph.D.  
University of Missouri, 1951

The velocity of detonation waves and the pressure contours have been determined in hydrogen-oxygen mixtures with various diluents. Tourmaline piezoelectric gauges were used as the detecting elements. Measurements were made over a range of initial pressures of the detonating mixtures.

It was found that there was both a composition limit and a critical low pressure limit below which stable detonation could not be induced. For hydrogen-air mixtures the composition limit of 18.5 percent hydrogen previously reported was extended to between 14 and 15 percent hydrogen by using more intense initiation. When argon and helium were used as diluents, the composition limits occurred between 6 and 5 percent and 6.9 and 6 percent hydrogen respectively. In all cases the low pressure limit rose with greater dilution. In the case of dilution with helium and argon, the low pressure limit appeared to merge continuously into the composition limit, while in the case of air dilution, the two limits met abruptly.

The lowering of the detonation limit by the monatomic diluents below those for the diatomic diluents may be explained largely as due to their lower specific heats, which therefore lead to higher detonation temperatures in the former case for corresponding compositions. Theoretical calculations of the temperatures of the limit mixtures qualitatively confirm this, although the temperatures with the monatomic diluents are still 200° lower than with air. The influence of temperature on the detonation limit is thought to be through its effect on the reaction rate. The importance of the reaction rate on the detonation limit was strikingly confirmed by the strong inhibiting effect of water vapor on the limit in hydrogen-air mixtures, where it was discovered that less than one tenth mole percent of water vapor could make the difference between a mixture being detonable and non-detonable.

Contrary to the idealized theory, the stable detonation velocity for a given mixture was found to decrease with decreasing initial pressure. With the hypothesis that the deviations from theory result from heat losses by radiation and conduction which become relatively greater at lower pressures, the theory can be corrected

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to conform with the observed result. It was found that an extrapolation to infinite pressure where the relative heat loss vanishes gives zero deviation from theoretical velocities.

Experiments with the mixture  $2\text{CO}-\text{O}_2$  indicate that the so-called "spin" phenomenon is definitely associated with a periodic pressure fluctuation in the wake of the detonation wave. Spin was observed in all other compositions used in this investigation. It was found to be intimately associated with the detonation limits.

Initiation of detonation using an easily detonable mixture behind a cellophane diaphragm was found to be dependent on the composition of the mixture, the initial pressure of the mixture, the ratio of the pressures in initiating mixture and the experimental mixture, and on the ratio of the average molecular weight of the initiating and experimental mixtures. The results are consistent with the hypothesis that the intensity of the shock wave produced in the mixture by the initiator is the important factor, and that there is a critical shock wave intensity for a given mixture below which stable detonation does not result. When the shock wave is of too low an intensity to initiate detonation, slow burning of the gas behind the shock front leads to a pressure rise in this region which causes acceleration and intensification of the shock wave and leads eventually to detonation.

#### A CRITICAL STUDY OF THE FACTORS EFFECTING THE PHYSICAL CHEMICAL DETERMINATION OF VITAMINS D IN OILS

(Publication No. 2498)\*

Manly Joy Powell, Ph.D.  
Michigan State College, 1950

An extensive study of some of the physical and chemical methods for removal of substances which interfere with the determination of vitamins D in oils was made. From these studies three methods for determining vitamins D were developed.

A colorimetric method, in which an antimony trichloride reagent is added to the nonsaponifiable fraction of irradiated ergosterols in corn oil, is proposed for oils having potencies of 10,000 vitamin D<sub>2</sub> units per gram or more. Potencies are calculated from extinctions measured at 500 mu. An average variation of 15.8% from the bioassay values was observed when this method was applied

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to 51 oils ranging from 1,200,000 to 100,000 vitamin D<sub>2</sub> units per gram. Six oils having potencies ranging from 14,000 to 10,000 vitamin D<sub>2</sub> units per gram showed an average variation of 16.4% from the bioassay value.

A second method, in which the nonsaponifiable fraction of an irradiated ergosterol in corn oil is adsorbed upon Superfiltrol from a Skellysolve-ethyl ether-alcohol mixture, is proposed for oils containing at least 50,000 vitamin D<sub>2</sub> units per gram. Vitamin D is collected in the filtrate and potencies are calculated from the extinction measured at 265 mμ. For 49 different oils, ranging from 1,200,000 to 200,000 units per gram, an average variation of 14.5% from the bioassay was observed. Five irradiated ergosterols in fish liver oil were also tested.

A third method which can be applied to both high and low potency irradiated ergosterols in corn oil, and possibly multivitamin oil solutions, was also developed. Vitamin A, carotenoids, pigments, and possibly toxisterol and lumisterol are first removed from a Skellysolve-ether solution of the nonsaponifiable fraction by means of a Superfiltrol column. The vitamins D in the filtrate are then separated from squalene type compounds by first adsorbing on and then eluting them from an alumina column using a Skellysolve-ether solvent mixture. The average deviation from bioassay values for six irradiated ergosterols and one crystalline D<sub>2</sub> solution in corn oil was 12.11%. These ranged from 1,000,000 to 9,680 D<sub>2</sub> units per gram and the method was shown to be accurate for oils having potencies as low as 2,000 to 3,000 units per gram. Seven multiple vitamin solutions were also tested giving varied results.

Very little correlation was observed between vitamin D potency values and the ultraviolet absorption curves of the untreated, the saponified, and the saponified oil solution treated with either or both digitonin and anhydrous HCl.

## THE STRUCTURE OF HIGH POLYMER-PLASTICIZER GELS AS REVEALED BY THE ELECTRON MICROSCOPE

(Publication No. 2640)\*

William Ralph Richard, Jr., Ph.D.  
University of Michigan, 1951

The objective of this work is to show the structure of high polymer-plasticizer gels as revealed by direct examination with the electron microscope.

\* Microfilm copy of complete manuscript of 205 pages, \$2.56.  
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Organomercury compounds, opaque to electrons as compared with a nitrocellulose supporting film, and sufficiently non-volatile to withstand a high vacuum and an electron beam, have been synthesized as contrast agents for the electron microscope. In particular, methyl  $\alpha$ -acetoxymercuri- $\beta$ -methoxypropionate (M.A.M.P.) and methyl  $\alpha$ -acetoxymercuri- $\beta$ -methoxyisobutyrate (M.A.M.I.) were utilized extensively.

M.A.M.P. and M.A.M.I. were tested as plasticizers for polyvinyl chloride-acetate copolymer (V.Y.N.S.), polyvinyl butyral, polyvinyl formal, polystyrene and nitrocellulose in films at concentrations from 0 to 250 parts by weight per 100 parts of polymer.

Thin films of these systems were examined in the electron microscope to learn the distribution of organomercury phase in high polymers and to record any phase separations. Phase separation did occur in the form of droplets, as small as  $140 \text{ \AA}$  in diameter, above a concentration limit which varied with the polymer and organomercury compound used. No other structure was visible.

The "stiffnesses" of milled samples of V.Y.N.S., polyvinyl butyral, polystyrene and polyvinyl formal, combined with M.A.M.P. and M.A.M.I. in four or five concentrations, were measured as a function of temperature using a Bakelite Clash-Berg torsion tester. The temperature of maximum slope,  $T_m$ , of the log stiffness-temperature curve was plotted as a function of the volume fraction of plasticizer,  $\phi_1$ .

The dielectric constant and dielectric loss of V.Y.N.S. plasticized with M.A.M.P. and di-2-ethylhexyl phthalate (D.O.P.) were measured in the temperature range  $-150^\circ \text{C.}$  to  $+120^\circ \text{C.}$  at 1 Kc. The temperature of maximum loss  $T_\epsilon$  "max" was plotted as a function of  $\phi_1$ .

The mechanical and electrical properties of polymers plasticized with M.A.M.P. and M.A.M.I. were correlated with the gel structure shown in electron microscope pictures of the same system.

The results of these investigations indicate that a high polymer gel is a molecular or near-molecular dispersion of plasticizer and polymer. Separation of the electron-opaque phase, presumably nearly pure organomercury compound, into droplets as small as  $140 \text{ \AA}$  in diameter in films, coincides with a marked decrease in plasticizing efficiency as judged by the physical properties of milled samples of the same systems. The slopes of  $T_m$  and  $T_\epsilon$  "max." vs  $\phi_1$  curves change to less negative values at the same concentrations as phase-separation appears.

THE DESIGN AND CONSTRUCTION OF A CATHODE-RAY  
OSCILLOSCOPE AND THE NECESSARY AUXILIARY  
EQUIPMENT FOR THE MEASUREMENT OF OVERVOLTAGE  
PHENOMENA, AND THEIR APPLICATION TO HYDROGEN  
OVERVOLTAGE ON SEVERAL METALS

(Publication No. 2663)\*

Dennis Robert Turner, Ph.D.  
University of Michigan, 1950

The principal objective of the present work was to design and construct an oscillograph together with the necessary auxiliary equipment that would be most suitable for the study of the nature of overvoltage and of electrode films. This objective has been accomplished, as its fairly extensive use has demonstrated.

Polarization at anodes and cathodes were studied through several types of experiments:

1. Cathodic polarization vx. current density data were obtained.
2. Natural cathodic polarization decay curves were studied.
3. Anodic and cathodic depolarization effects immediately following cathodic and anodic pretreatments respectively were photographed.

The stable electrode potentials under a variety of conditions were measured with a potentiometer. Experiments involving potential changes with time were recorded on films with the cathode-ray oscillograph.

The so-called decomposition potentials of the cathode potential-current density curves for bright platinum, bright palladium, copper, lead, nickel and silver were shown to have no special significance with regard to the mechanism producing the hydrogen overvoltage.

Cathodic polarizations decay in two stages, the first decay is rapid, and is attributed to the removal of atomic hydrogen from the electrode-solution interface; the second a slow decay, extends to the establishment of an equilibrium condition at the electrode-solution interface.

Anodic depolarization effects for the metals studied in this research, following a cathodic pretreatment, were determined as due to the following anodic reactions:

Platinized platinum: 1) The reionization of absorbed hydrogen atoms; 2) The discharge of hydroxyl ions and subsequent adsorption of oxygen atoms.

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Bright platinum: 1) The reionization of absorbed hydrogen atoms which diffuse to the surface from within the metal; 2) The discharge of hydroxyl ions and subsequent adsorption of oxygen atoms.

Copper: 1) The discharge of hydroxyl ions and formation of an oxide; 2) The formation of copper ions.

Lead: 1) The formation of lead ions and subsequent precipitation of  $\text{PbSO}_4$  at the electrode surface.

Nickel: 1) The formation of nickel ions; 2) The breakdown of some nickel-atomic hydrogen complexes.

Silver: 1) The formation of silver ions and subsequent precipitation of two compounds, first  $\text{Ag}_2\text{SO}_4$  and then  $\text{Ag}_2\text{O}$ .

The cathodic depolarization effects on the metals studied following an anodic pretreatment were attributed to the following cathodic reactions:

Platinized platinum: 1) The reionization of adsorbed atomic oxygen and molecular oxygen at the electrode-solution interface; 2) The discharge of hydrogen ions and subsequent adsorption of atomic hydrogen.

Bright platinum: 1) The reionization of adsorbed atomic oxygen and molecular oxygen at electrode-solution interface.

Copper: 1) Cathodic reduction of oxide layer; 2) Deposition of copper ions formed anodically.

Lead: 1) Cathodic reduction of  $\text{PbSO}_4$  to free lead.

Nickel: No appreciable depolarization process observed.

Silver: 1) Cathodic reduction of  $\text{Ag}_2\text{O}$  to free silver; 2) Cathodic reduction of  $\text{Ag}_2\text{SO}_4$  to free silver.

In addition to being able to identify these electrode reactions, it was possible to make certain quantitative measurements on many of them.

Experiments on the cathodic deposition of hydrogen support the general atomic hydrogen theory of overvoltage. The experimental technique of polarization study, by means of depolarization effects, produced by electrode reaction products prior to reversing the current direction, have been demonstrated to be an excellent means for the analysis of electrode reactions and a study of their mechanics.

## THE KINETICS OF COPOLYMERIZATION OF VARIOUS ACRYLATE SYSTEMS

(Publication No. 2566)\*

John William Vanderhoff, Ph.D.  
University of Buffalo, 1951

The purpose of this investigation was to obtain the previously unreported values for the ratios of the rate constants for various two-component acrylate and methacrylate copolymerization systems and to determine the effect of a homologous series of substituents on these ratios.

Six monomers were chosen for this study: styrene, methyl acrylate, ethyl acrylate, methyl methacrylate, ethyl methacrylate, and butyl methacrylate. All but one of the fifteen possible systems were measurable by the method used.

The problem was essentially one of analysis of the copolymer initially formed. Refractive index measurements were used as a method of copolymer analysis. All measurements were made at 85° C. in order that the temperature of measurement would be above the highest "apparent second-order transition point" of the polymers involved.

Calibration samples of various compositions were prepared for each system by polymerizing monomer mixtures to completion. Determinations were made at 50° C. and 70° C. The methyl-acrylate-butyl methacrylate system was not measurable because of the small difference of the refractive indices of the polymers involved.

The results of this investigation indicate that the presence of a substituent in the acrylate structure has a definite effect on the behavior of the monomer in copolymerization. The effect of the nature of the substituent, although measurable, is small.

In order of decreasing reactivity, the monomers are: methyl methacrylate, butyl methacrylate, ethyl methacrylate, ethyl acrylate, and methyl acrylate.

In order of decreasing polarity of the double bond, the monomers are: methyl acrylate, ethyl acrylate, ethyl methacrylate, methyl methacrylate, and butyl methacrylate.

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\* Microfilm copy of complete manuscript of 104 pages, \$1.30.  
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<u>Monomer</u>	<u>Summary of Q and e Values</u>	
	<u>Determinations at 50°C.</u>	<u>Determinations at 70°C.</u>
Methyl Acrylate	$Q = 0.386 \pm 0.009$	$Q = 0.380 \pm 0.003$
	$e = 0.80 \pm 0.07$	$e = 0.45 \pm 0.02$
	Total Average: $e = 0.63 \pm 0.17$	
Ethyl Acrylate	$Q = 0.416 \pm 0.002$	$Q = 0.396 \pm 0.024$
	$e = 0.58 \pm 0.01$	$e = 0.37 \pm 0.14$
	Total Average: $e = 0.48 \pm 0.13$	
*Methyl Methacrylate	$Q = 0.396 \pm 0.027$	$Q = 0.329 \pm 0.038$
	$e = 0.61 \pm 0.02$	$e = 0.11 \pm 0.04$
Ethyl Methacrylate	$Q = 0.508 \pm 0.005$	$Q = 0.490 \pm 0.038$
	$e = 0.50 \pm 0.02$	$e = 0.56 \pm 0.19$
	Total Average: $e = 0.53 \pm 0.11$	
Butyl Methacrylate	$Q = 0.705 \pm 0.003$	$Q = 0.689 \pm 0.003$
	$e = 0.11 \pm 0.01$	$e = 0.25 \pm 0.01$
	Total Average: $e = 0.18 \pm 0.07$	

\*These values do not agree with the values previously reported ( $Q = 0.74$  and  $e = 0.4$ ). The previously reported values are probably the most reliable.

NOTE: The underlined "e" values are probably the best values.

## THE CHEMISTRY OF THE POLYTHIOETHERS OF SILICON

(Publication No. 2567)\*

Leon E. Wolinski, Ph.D.  
University of Buffalo, 1951

Three methods were developed for the preparation of trialkylmercaptosilanes, using the sodium alkyl mercaptide and trichlorosilane in benzene at 0°, using the sodium alkyl mercaptide and trichlorosilane in toluene at -70° and using the alkyl mercaptan, trichlorosilane and pyridine in benzene solution at 0°.

\* Microfilm copy of complete manuscript of 133 pages, \$1.66. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-310.

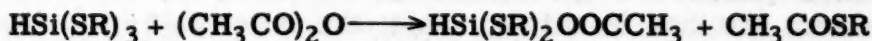
The trialkylmercaptosilanes prepared were methyl, ethyl, n-propyl, i-propyl, n-butyl, i-butyl and t-butyl.

Complications developed in the method of preparation at  $-70^{\circ}$ . Using the sodium n-butyl mercaptide and trichlorosilane, di-n-butylmercaptosilane and tetra-n-butylmercaptosilane were obtained in one run. Using sodium t-butyl mercaptide, di-t-butylmercaptosilane and tri-t-butylmercaptosilane were obtained.

Using the pyridine salt method, tri-n-butylmercaptosilane was not obtained, only tetra-n-butylmercaptosilane was found. Tri-t-butylmercaptosilane could not be prepared by the pyridine salt method either; only an impure di-t-butylmercaptosilane was obtained.

The yields were consistently higher using the pyridine salt method for trialkylmercaptosilanes, with the sodium salt method at  $-70^{\circ}$  they were less, while that at  $0^{\circ}$  gave the lowest yields. High temperatures and/or excess sodium mercaptide tended to give the tetraalkylmercaptosilanes.

The action of acetic anhydride on trialkylmercaptosilanes was studied. Alkyl thiolacetates were obtained in more than 100% yields based on the initial metathetical reaction.



The yields of alkyl thiolacetates above 100% and the glassy polymers which were obtained were attributed to the thermal decomposition of the dialkylmercaptoacetoxysilanes.

Benzoyl chloride was found to react with triethylmercaptosilane to form ethyl thiolbenzoate and diethylmercaptosilane. The conditions of the reaction were studied to ascertain the effect of variations of temperature, time and concentration on the yields.

The series of trialkylmercaptosilanes were brominated under various conditions. The variables used were temperature (room temperature,  $0^{\circ}$  and  $-70^{\circ}$ ) and concentration (molar ratios of two to one, one to one, one to two). The reactions in molar ratios of two trialkylmercaptosilanes to one of bromine gave the most interesting results. At room temperature, without external cooling, non-separable mixtures were obtained. At  $0^{\circ}$ , bromine attacked the silane hydrogen in the majority of cases to give hydrogen bromide and trialkylmercaptobromosilanes. At  $-70^{\circ}$  the tendency to cleave the silicon-sulfur bond became more dominant with consequent production of dialkyl disulfides and dialkylmercaptobromosilanes. A mechanism for this reaction was proposed, as well as a suggestion that the reaction may be made still more selective by operating at temperatures below  $-70^{\circ}$  in suitable solvents.

Analytical methods were extended to alkylmercaptosilanes, and a discussion of the comparative reactivities of the various silicon bonds encountered ordinarily in organosilicon work was made.



ANTISPASMODICS: BETA-DIETHYLAMINOETHYL  
ESTERS OF SUBSTITUTED ALPHA-ARYL-BETA-  
HYDROXYPROPIONIC ACIDS

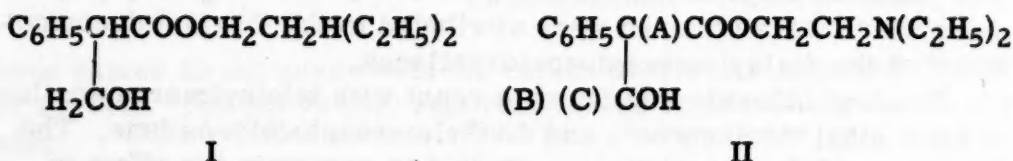
(Publication No. 2638)\*

Harold Raffelson, Ph.D.  
University of Michigan, 1951

The object of this investigation was the preparation of basic-alkyl esters of substituted  $\alpha$ -aryl- $\beta$ -hydroxypropionic acids. These esters were of interest because of their possible value as therapeutic agents, especially antispasmodics.

Hitherto, all of the synthetic esters, described in the literature which had been obtained from tropic acid and a simple basic alcohol, for example  $\beta$ -diethylaminoethyl tropate (I), proved to be inferior in antispasmodic activity when compared with the alkaloid atropine which is an ester of tropic acid and the complex basic alcohol tropine.

It seemed possible to us that simple basic-alkyl esters of substituted tropic acids might be more potent antispasmodics than similar esters obtained from tropic acid; the latter acid is  $\alpha$ -phenyl- $\beta$ -hydroxypropionic acid. Consequently, during this investigation we



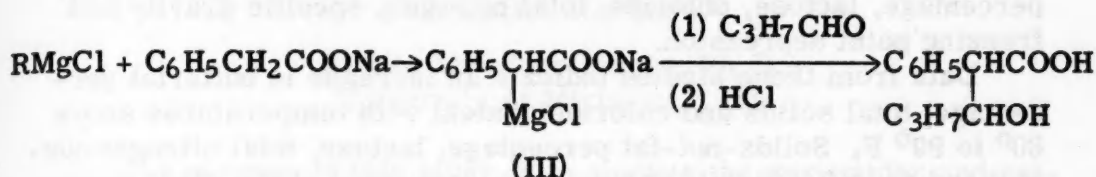
prepared a number of esters which correspond to general formula II; in this formula A represents groups such as hydrogen, ethyl, phenyl, benzyl or phenoxy; B represents hydrogen, alkyl or phenyl; C represents hydrogen, alkyl or phenyl; B-C represents tetramethylene,

pentamethylene or  $o\text{-C}_6\text{H}_4$   $\begin{array}{c} \text{CH}_2 \\ \diagup \quad \diagdown \\ \text{CH}_2 \end{array}$ . In addition, esters of general for-

mula II have been synthesized in which the phenyl group was replaced by 2-thienyl, 3-thienyl and p-xenyl. All of the  $\beta$ -hydroxy acids, required for the preparation of the basic esters, were prepared by use of the little-known Ivanoff reaction. The characteristic feature of this reaction is the use of a Grignard reagent, such as III, prepared from the salt of an arylacetic acid. This Grignard reagent is then allowed to react with other substances such as ketonic compounds.

\* Microfilm copy of complete manuscript of 127 pages, \$1.59.  
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For example, Ivanoff and his associates had shown that the chloromagnesium derivative of sodium phenylacetate reacts with butyraldehyde to produce  $\alpha$ -phenyl- $\beta$ -hydroxycaproic acid ( $\alpha$ -phenyl- $\beta$ -propyl- $\beta$ -hydroxypropionic acid,  $\beta$ -propyltropic acid).



We discovered that tropic acid can be obtained, in good yield by interaction of III with formaldehyde.

A total of thirty acids were prepared, twenty-eight of them by the Ivanoff reaction; nineteen of the acids had not been synthesized hitherto.

All of the acids, except  $\alpha$ -phenyl- $\gamma$ -hydroxybutyric acid, were converted into their  $\beta$ -diethylaminoethyl esters by means of the Horenstein-Pahlicke procedure. Twenty-three of the esters have been tested for antispasmodic activity under the direction of Dr. A. N. Lands at the Sterling-Winthrop Research Institute. Five of the esters were active against acetylcholine in a dilution greater than that of 1:20,000,000. The most potent ester,  $\beta$ -diethylaminoethyl phenyl-(1-hydroxy-1-cyclohexyl)-acetate, exhibited activity in a dilution of 1:87,000,000.

## DAIRY HUSBANDRY

### THE INFLUENCE OF VARYING ENVIRONMENTAL TEMPERATURE ON THE COMPOSITION OF MILK OF THE DAIRY COW

(Publication No. 2673)\*

James William Cobble, Ph.D.  
University of Missouri, 1951

Changes in the composition of the milk of dairy cattle as a result of varying environmental temperatures were studied on forty-three cows in the Psychroenergetic Laboratory at the University of Missouri.

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Environmental temperatures ranging from 5° to 105° F. were used in the studies. Some twenty-five hundred samples of milk from Jersey, Holstein, Brown Swiss and Brahman cows were collected and analyses were made for total solids, butterfat, solids-not-fat percentage, lactose, chloride, total nitrogen, specific gravity and freezing point depression.

Data from these studies indicate an increase in butterfat percentage, total solids and chloride content with temperatures above 80° to 90° F. Solids-not-fat percentage, lactose, total nitrogen content and specific gravity values were depressed at the same temperature levels. Total milk yield was decreased 50 to 75 percent at ambient temperatures above 80° F. in Holstein and 85° F. for Jersey and Brown Swiss cows. The Brahman cows showed no apparent effect in milk yield or milk composition at high environmental temperatures. The freezing point depression values on milk from Brown Swiss cows showed no significant change at high environmental temperatures.

Daily milk yields were found to decrease for Jersey cows at approximately freezing temperatures whereas the Holstein cows showed no noticeable decrease in milk yield attributed to low temperatures except during a period of two weeks when the temperature was suddenly decreased to 4° F. At low ambient temperatures it was found that butterfat, total solids, solids-not-fat and total nitrogen content increased. Little, if any, changes occurred in the specific gravity and freezing point depression values of milk with cows maintained at the low environmental temperatures. Although some variation was observed in the lactose and chloride content of the milk no definite trend could be established indicating an influence of low temperatures. At both extremely high and extremely low environmental temperatures a low butterfat solids-not-fat ratio was obtained.

It is concluded from these data that environmental temperatures ranging from 40° to 75° F. do not materially influence milk yield or milk composition in dairy cattle of European ancestry. Temperatures below or above this range (40° to 75° F.) were found to cause substantial changes in the composition and yield of milk.

**SOME SIGNIFICANT FACTORS INFLUENCING THE RANGE  
OF INDETERMINATENESS IN COLLECTIVE  
BARGAINING NEGOTIATIONS**

(Publication No. 2608)\*

Arthur Theodore Jacobs, Ph.D.  
University of Michigan, 1951

The purpose of this study is to analyze the way unions and employers engaged in negotiating a labor agreement set the lower and upper limits of their demands and offers; the forces which induce negotiators to move toward each other's position within the range of indeterminateness between the employer's minimum offer and the union's maximum demands until they come together at a point of settlement; and the impact which negotiations so influenced and conducted have upon the economy as a whole.

This analysis is largely based on the experience of union and management negotiators, supplemented by the observations of arbitrators, mediators, and other neutral labor relations experts. The literature on bilateral monopoly, bargaining power, wage setting, and contract negotiations has also been examined, but only a small part of it proved pertinent or useful.

Two chapters discuss the concept and importance of the range of indeterminateness in collective bargaining negotiations. Economic theory seems to assume that this range is rather narrow. Analysis of the differences between collective bargaining and property bargaining and the virtually universal experience of collective bargaining practitioners prove, instead, that the range is probably very wide. However, where collective bludgeoning or pattern bargaining prevails, no range of indeterminateness exists at all.

Chapter III analyzes the major factors which appear to determine where employer and union set the lower and upper limits of their individual ranges — their economic needs as they see them, their attitudes toward collective bargaining in general and toward each other in particular, the employer's relations with his employees, the union's problems with its rank and file, inter-and-intra-union rivalry, the influence of either party's non-economic objectives, the pressures of other unions and managements and of the general public, etc.

Two chapters analyze the influence of the Government and find it all-pervasive. Laws restrict the scope of negotiations and regulate

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its conduct. Mediators, arbitrators, fact-finders, officials at all levels of government exert pressures. In turn, they all are exploited and manipulated into bargaining tools by negotiators so as to achieve the negotiators' collective bargaining goals.

Three chapters, devoted to the art of bargaining, bring out the importance of negotiating skill, the numerous techniques and tricks of the trade which negotiators employ, and the planned and fortuitous happenings at the bargaining table, all of which significantly determine the final settlement.

This study indicates that (1) the range of indeterminateness in collective bargaining is usually quite wide, (2) negotiating skill significantly affects the final settlement, (3) a significant proportion of strikes and other labor trouble is caused by faulty bargaining technique, (4) the theory of bilateral monopoly has little, if any, applicability to the determination of the terms of a labor agreement, (5) "bargaining power" is a meaningless concept in labor relations, (6) the settlement terms coming out of thousands of collective bargaining negotiations probably never add up to a logical, coherent pattern useful in planning public policy, and (7) the inevitable effect of negotiations is to push money wage costs ever upwards.

#### THE PROBLEM OF ECONOMIC DEVELOPMENT IN BACKWARD AREAS WITH SPECIAL REFERENCE TO IRAN

(Publication No. 2639)\*

Alfred S. Ray, Ph.D.  
University of Michigan, 1951

The purpose of this study is to establish a goal for economic development in backward areas and estimate the time necessary to achieve this goal. Iran is used as a case study.

This thesis is divided into three parts. Chapter I deals with the establishment of a goal for economic development. The desired degree of economic development is computed at a level which would allow the minimum per capita calorie intake considered necessary for physiological well-being. In view of the nature of the problem and the data available, seven methods of computation are used. The differences in the various methods and in the results are largely explained by the variations in their treatment of exchange rates and the extent to which they take account of inter-country differences in food prices.

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\* Microfilm copy of complete manuscript of 295 pages, \$3.69.  
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The problem of economic development is considered here as primarily a problem of capital formation. Thus the rate of development is calculated as a function of the rate of capital formation. In Chapter II, the ratio between changes in investment and in income are computed in order to estimate the productivity of capital in Iran. This ratio is obtained by analyzing the investments recommended in the various economic development plans for Iran, and calculating the expected change in income resulting from the investments. To check the validity of the results, the income investment ratio is tested against time series correlations of total investment and income for various countries.

In Chapter III, the rate of economic development is computed by developing a functional time relationship between income and capital accumulation. Thus, given the marginal productivity of capital, the marginal propensity to save and the position of the balance of payments, it is possible to calculate changes in capital accumulation and income over time. This relationship has general application. In this thesis it is used to compute the amount of time necessary to raise per capita income in Iran from its present level to that estimated in Chapter I.

Two conclusions can be drawn from the study: 1) In Iran, the per capita income which would allow the minimum per capita calorie intake considered necessary for physiological well-being is calculated at approximately U.S. \$ 150 at 1947 prices. 2) The time necessary to raise per capita income in Iran to this level ranges between 8 and 22 years, depending on the assumptions made concerning the amount and productivity of added capital. These results must be considered as potential rates of development. The actual rates of development would depend on the speed with which the economic, social, and political milieu can change in order to absorb and successfully accommodate the capital requirements computed in the study.

## EDUCATION

### THE IMPLEMENTATION OF EDUCATIONAL PHILOSOPHY AND A PROGRAM OF EDUCATIONAL RESEARCH IN THE CURRICULAR GROWTH OF STEPHENS COLLEGE

(Publication No. 2670)\*

Ward Elwood Ankrum, Ed. D.  
University of Missouri, 1951

Major Adviser: Ralph K. Watkins

#### Statement of Problem

This is an examination of the relationship of the curricular changes at Stephens College with the findings of its department of educational research. Since the findings of the research department of the college are based largely upon activity analysis and analysis of ideals, the principal problem of this dissertation becomes that of determining the extent to which the educational program of Stephens College has evolved from an analysis of activities and ideals.

Since the program of educational research and curricular revisions was under the direction of W. W. Charters from 1920 to 1949, the changes in the Stephens College program are compared with the ideas proposed by Charters.

#### Method of Attack

The writer has employed a method of documented comparison in an attempt to resolve the problem.

#### Conclusions

1. The functionalism which W. W. Charters emphasized in CURRICULUM CONSTRUCTION (1923), THE TEACHING OF IDEALS (1927), METHODS OF TEACHING: THEIR BASIS AND STATEMENTS DEVELOPED FROM A FUNCTIONAL STANDPOINT (1912), and other writings has been incorporated in the Stephens College educational program as evidenced by the major projects of the Research Department, including WOMEN'S EDUCATION, A FUNCTIONAL STUDY (1922), the development of the orientation courses, The Ten Ideals, and the divisional program of the college. The development of these aspects of the educational program was reported in the annual BULLETINS of Stephens College, THE STEPHENS COLLEGE PROGRAM FOR THE EDUCATION OF WOMEN (1933 and 1938), and THE TWENTY-FIFTH ANNUAL REPORT TO THE FACULTY; THE ENGINEERING FUNCTION IN EDUCATION (1947).

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2. The philosophy of Charters and the program of educational research were implemented in the Stephens College educational program under favorable circumstances which cannot be minimized.

3. The major research projects at Stephens College were conducted by members of the faculty who worked under the direction of Dr. Charters.

4. Although the four-year junior college did not achieve the acceptance which James M. Wood desired, it did provide the Research Department with opportunities to implement important research projects in the educational program.

5. The divisional program, which was initiated by Charters in 1930, has been retained.

6. The identification of a course with the division to which it belonged proved difficult in various cases.

7. The divisional program has provided a means of emphasizing the nature of the subject matter of courses and departments.

8. Although the framework of the divisional program has been retained, including administration of the educational program through divisional chairmen, the departments of 1929 have tended to be re-established as departments under the divisions.

9. The distribution of courses in departments of 1929 into the divisional program of 1930 and the subsequent reformation of these departments under the divisions indicated that in the Stephens College curricular revision, the grouping of courses according to their functions was not as strong as the arrangement of courses according to their assumed progressive difficulty and structural relationships.

10. The program of seven subjects which Charters suggested for the new curriculum did not materialize. The proposed required subjects were Aesthetics-Humanities, Social Problems, Communications, Ethics-Philosophy, Health-Hygiene, Psychology-Mental Health, and Consumer Education.

11. The Division of Communications developed from extensive research projects.

12. The Division of Languages did not result from a concept of Charters, nor was it included in the list of twenty-five classes of activities of college-trained women as determined from WOMEN'S EDUCATION, A FUNCTIONAL STUDY, nor was it advocated by Charters as a required subject in the new curriculum, nor did it develop from a major research project. The distribution of language courses over three divisions proved impractical.

### Recommendations

In view of the findings of this study, the following recommendations are made:

1. If it is to be the continuing policy of Stephens College to build a program that will implement the ideas of curriculum construction



expressed by W. W. Charters, the college should now review the elements of its existing program to determine their consistency with the ideas expressed by Charters.

2. If it is to be the policy of Stephens College to change its framework of investigation and program building, the new concepts should be expressed explicitly, and the differences between the new concepts and those of Charters should be stated.

3. Since many of the investigations upon which the educational program of Stephens has been built are now old, and social and economic conditions have changed, a new series of investigations, in many ways similar to the original studies, should be started at once in order to examine elements of the program in terms of present needs of the students.

#### RELATIONSHIPS OF BODY BUILD, PHYSICAL PERFORMANCE, INTELLIGENCE, AND RECREATIONAL INTERESTS, TO OCCUPATIONAL CHOICE

(Publication No. 2572)\*

Jack Begelman, Ph. D.  
University of Michigan, 1951

A study was made of the relationships of various factors, recreational interests in particular, to the vocational choices of college students. The emphasis was placed upon interests since this approach is increasingly receiving attention as an exploratory area for vocational guidance. A Recreational Interest Inventory was utilized for this purpose.

The purpose of this study was to determine if the various groups of tests as well as the separate items within each group would help to differentiate students enrolled in one school from those in another, and also to find out if the test results could be used as a guide in the selection of their occupation.

The data were collected at Oregon State College, Corvallis, Oregon, in the academic year of 1949-50. The individuals tested were entering male freshmen; the approximate size of the group was 950 students. Of these, 727 were given body-build classification; 543 were given seven physical performance tests; 846 took the American Council on Education Psychological Examination; 812 were decile-ranked according to high school averages; 579 participated in the mathematics examination, 821 in the grammar test, 807 in the reading section of

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\* Microfilm copy of complete manuscript of 253 pages, \$3.16.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-315.

the English examination; and 942 completed the Recreational Interest Inventory.

The Recreational Interest Inventory contained 239 items which were classified under five main headings of interests: School Subjects; Sports and Games; Cultural Activities; Social Activities and Organizations; and Hobbies, which included items of experimental, collecting, and creative nature.

Differences between all scores were obtained and these were subjected to an analysis for significance through the use of the Fisher modification of Student's *t*-test of significance between the means, and the Snedecor *F*-test. The  $X^2$  goodness-of-fit test was used to ascertain the significance of the difference between the various schools in relation to adipose tissue and muscle.

Some results were inconclusive. Some findings further substantiated the conclusions of previous investigations. Other results, especially in the interest area, provided new additions to knowledge and indicated a rich field for further exploration. In interpreting the findings, it must be kept in mind that the study was specific to Oregon State College, and that only nine occupations were studied.

The analysis showed that many tests and interest items were related to vocational choice; and conversely, showed that there is little or no relationship between certain test items contained in the study and vocational selection. The latter was the case with physical performance, adipose tissue, muscle tissue, and certain items on the Recreational Interest Inventory.

The findings revealed that the traditional tests based on intelligence and intellectual achievement differentiated the most between the students enrolled in groups of schools. These school groupings were: (1) Engineering, Science, and Pharmacy; (2) Business, Lower Division, Agriculture, and Education; and (3) Physical Education.

However, the traditional tests, although they distinguished between broad groupings did not sufficiently account for individual variances within the group. In this connection, the items of the Recreational Interest Inventory provided additional clues for differentiation between and within broad groupings.

In conclusion, the study revealed that the traditional tests alone were not completely adequate for use in vocational guidance. This study has shown how their findings can be enhanced by the additional information supplied by the use of a Recreational Interest Inventory.

**SOME ENVIRONMENTAL FACTORS AND COMMUNITY  
INFLUENCES THAT ARE BROUGHT TO BEAR UPON  
THE LIVES OF MISSOURI TEACHERS AND ADMINISTRATORS**

(Publication No. 2671)\*

Albert Byron Callaway, Ed.D.  
University of Missouri, 1951

**Purpose:**

The purpose of this study was to determine some of the environmental factors and community influences brought to bear upon the lives of Missouri teachers and administrators.

**Method of Research:**

Information blanks were used to obtain the major part of the data. Blanks were mailed to 5,100 Missouri teachers, selected from the membership list of the Missouri State Teachers Association, excepting St. Louis, Kansas City, and out-of-state lists. This list was divided into districts and major towns and the proportional number was selected from each. This method assured statewide coverage outside of the exceptions mentioned above. Usable returns were received from 36.23 percent or 1,843 teachers.

**Conclusions:**

For the group studied, approximately one-fourth have some pressures brought to bear, affecting such personal habits and entertainment as dancing, card playing, smoking, and social drinking. These pressures appear to be of the indirect type.

Almost one-fourth of the group do not feel that they are fully accepted by the community. More than half do not belong to either civic or social groups in the community.

The majority participate in several forms of entertainment and hobbies in their leisure time.

As a group, Missouri teachers and administrators attend church, generally once a week. There is some community pressure for attendance but it affects only every fifth person.

As a general rule, teachers and administrators report that they have political freedom. There is some pressure for them not to participate in elections and some as to how they should vote, but this is not extensive. Many are encouraged to participate in elections. There are too many teachers and administrators who do not take part in elections.

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\* Microfilm copy of complete manuscript of 358 pages, \$4.48.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A51-412.

Although there are some individuals who have pressure brought to bear to prevent them from teaching certain controversial topics, the major problem in this area is that the greater number do not teach controversial issues even when there is no opposition.

The majority of Missouri teachers and administrators have the usual modern conveniences available in their living quarters. There is a trend in direction of home ownership by teachers and administrators.

Teachers usually carry life insurance and have some other type of regular savings, usually government bonds, property, or regular bank savings.

Generally, Missouri teachers and administrators have various medical services available in the community where they teach and utilize some of these services during a year's time.

As a group they are evenly divided as to whether or not their salary is adequate to provide the type of clothing they feel they should wear.

A large amount of the time of teachers and administrators outside of the regular school day is occupied with duties either directly concerned with the regular school work or indirectly related to the school. Seldom do they receive extra compensation for these duties.

Teachers and administrators spend some time, out of school, working on various community and civic activities.

Missouri teachers and administrators usually attend college during the summer and frequently travel or work for the school. As a rule weekends are spent in the community where they are employed.

There is a slightly less than even chance that teachers and administrators are employed in their home towns.

There is a trend for schools to establish a plan for granting annual sick leave, with pay.

It appears that Missouri teachers and administrators do not purchase many professional books and magazines. The amount of these materials furnished by the school is very small.

Most administrators appear to be democratic in the operation of their schools, although a substantial number are reported as autocratic to some degree.



## A CRITICAL STUDY OF STATE DEPARTMENT OF EDUCATION HANDBOOKS

(Publication No. 2672)\*

Ernest Herbert Campbell, Ed. D.  
University of Missouri, 1951

Major Adviser: Dr. John Rufi

### Purpose of Study:

The purposes of this study were to learn of those states in which the Department of Education publishes a handbook for school administrators, determine those items included in the handbooks published, gain professional advice concerning the value and need of such publications, and finally, arrive at a summarization of a suggested practical publication.

### Research Technique:

A questionnaire was distributed among the chief state school officers of the forty-seven states other than Missouri. This questionnaire contained items thought to be essential to an adequate publication of an administrators handbook. The respondents were asked to mark the questionnaire "yes" or "no" depending upon whether or not their handbook included each individual item and further to indicate in the appropriate column whether they thought the item should be included in the handbook.

A second questionnaire was prepared by members of the Missouri State Department of Education and distributed among the school administrators of the public schools of Missouri. This questionnaire pertained to a proposed handbook for Missouri schools and was used for this study.

Finally, the materials gathered by questionnaires were supplemented by an extensive study of all state department of education handbook publications which could be secured by the writer.

### Major Findings and Recommendations:

1. Thirty-four state departments of education or state departments of public instruction publish handbooks and six additional chief state school officers expressed the belief that a handbook is necessary to good school administration.
2. The most commonly utilized source of data and material is the state committee.

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\* Microfilm copy of complete manuscript of 220 pages, \$2.75.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-413.

3. Twenty-two states include all the handbook material in one publication. Two states have separated the handbook for elementary and secondary levels of administration. Ten states publish a series of pamphlets or bulletins on specific topics.

4. Judging by their practices, the majority of states believe that philosophical material is essential to a published handbook. Twenty-five percent of the administrators of the public schools of Missouri objected to inclusion of broad philosophical discussions.

5. Regional accrediting associations are discussed briefly in eleven department of education handbooks. Accreditation of non-public and parochial schools is of concern to twenty-three states and is outlined in their handbooks.

6. Adult education programs are included in the discussions of fourteen department of education handbooks. Public relations programs are included in but thirteen handbooks but twenty-one chief state school officers favor inclusion of such material.

7. Calendars of records and reports are published in the handbooks of thirty departments of education and supporting opinions were expressed by eleven other chief state school officers.

8. Requirements for admission to the various school grades is outlined in eighteen handbooks and sixteen other state officers believe it is an essential part of a publication.

9. Discussion of special services such as guidance programs, transportation, lunch room facilities and vocational education are included in a large percentage of the handbooks now published.

10. The importance of discussion of teacher certification, teacher selection, and salary scheduling is evidenced by the fact that the majority of the states either now publish such material or would include it in a handbook.

11. Organization and administration of school libraries is included in the discussion of twenty-six state departments and six additional chief state school officers would include this type of material.

12. Discussion of the extra-curricular program would be included by twenty-two chief state school officers and representatives of thirty states indicate that a uniform accounting of extra-curricular funds is advisable and should be outlined in a handbook.

13. Eighteen states include school building construction regulations in the handbook and eleven others would include such material in a revision of the handbook.

14. Thirty-two chief state school officers believe that listings of essential equipment and materials consistent with classification standards should be included in the handbook.

15. Standards of health and sanitation as determined by the school program and building are believed by forty-two chief state school officers to be essential to a complete publication.

16. A discussion of school finance is believed to be essential

by all chief state school officers responding and by 100 percent of the Missouri administrators who responded to the questionnaire.

**NON-INTELLECTIVE FACTORS IN CERTAIN INTELLIGENCE  
AND ACHIEVEMENT TESTS  
AN ANALYSIS OF FACTORS IN ADDITION TO THE COGNITIVE  
ENTERING INTO THE INTELLIGENCE AND ACHIEVEMENT  
SCORES OF CHILDREN AT THE SIXTH GRADE LEVEL**

(Publication No. 2503)\*

Jack Z. Elias, Ph.D.  
New York University, 1951

Constructors and users of group tests of intelligence and achievement generally assume that these tests measure elements within the intellectual or cognitive area. This study attempts to investigate, through factor analysis, the extent to which personality attributes in addition to the cognitive are factors which enter into such intelligence and achievement test scores of children in the sixth grade.

The subjects consisted of two undifferentiated groups, each of 144 white children who showed no marked deviations in age, physical health or reading ability. Various group tests of intelligence, achievement and those believed to reveal certain aspects of personality were administered, and the variables age, sex and socio-economic status utilized to obtain a total of 33 scores for each subject. A complete list of the tests and other variables follows:

Stanford Achievement Test, Intermediate, Form E.

1. Paragraph Meaning.
2. Word Meaning.
3. Arithmetic Reasoning.
4. Arithmetic Computation.

SRA Primary Mental Abilities, Intermediate, Form AM

5. Verbal.
6. Space.
7. Reasoning.
8. Number.
9. Word Fluency.

New California Test of Mental Maturity, '47 S-Form, Elementary.

10. Sensing Right and Left.
11. Manipulation of Areas.

\* Microfilm copy of complete manuscript of 310 pages, \$3.88.

Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-244.

12. Similarities.
13. Inference.
14. Number Series.
15. Numerical Quantity.
16. Vocabulary.

**Revised Beta Examination.**

17. Mazes.
18. Digit-Symbol.
19. Error Recognition.
20. Picture Completion.
21. Age.
22. Sex.
23. Arrow Test.
24. Cancellation.
25. Digits Forward.
26. Digits Backward.

**California Test of Personality, Elementary.**

27. Self-Adjustment.
28. Social Adjustment.
29. Word Association, Neutral Words.
30. Word Association, Complex Words.
31. Guess-Who.
32. Word Naming.
33. Index of Status Characteristics.

Inter-correlations for the 33 variables were computed and the resulting correlation matrix was factor analyzed according to Thurstone's Centroid Method. Orthogonal axes were used for all rotations. Separate studies were performed for each group.

For the first group, consisting of 86 boys and 58 girls, the factors tentatively identified were: general, verbal, spontaneity, attention and two whose meaning is less clear, pseudo-adjustment and reactivity. For the second group, consisting of 69 boys and 75 girls, the factors were: general, verbal, attention, spontaneity and two less clear, designated as reactivity and social maladjustment. Factors were classified tentatively on the basis of test content and/or previous factorial research as follows: general and verbal - intellectual; attention, spontaneity, social maladjustment, pseudo-adjustment and reactivity - non-intellective.

The major non-intellective factor entering in the four Stanford Achievement tests was attention. These tests appeared to be better measures of the general factor than were the intelligence tests. The non-intellective factors entering in tests of intelligence varied from test to test, the major factors being attention and spontaneity. The former occupied a significant role in the California and in the Beta tests; the latter in Thurstone's Word Fluency and Number tests.



An analysis of the accountable variance of each test revealed that all tests measure the intellectual and non-intellectual elements to various degrees. The differences between the two groups in factorial loadings of tests suggested the need for ample sampling studies before attempting to interpret the factorial meaning of any test score.

Significant sex differences were found for certain tests. The girls tended to excel in tests relating to fluency, verbal ability and social adjustment. The boys excelled in fewer tests mainly spatial in nature. Socio-economic status was not shown to be a major element in any of the factors extracted. Since 70 percent of the subjects came from the upper-lower and lower-middle classes it is possible that there was insufficient variance to bring out its significance more sharply.

The writer views this study as exploratory rather than conclusive. There is a need for intensive exploration through many similar investigations.

#### **AN INVESTIGATION OF TECHNIQUES USED IN DETERMINING SCHOOL BUILDING NEED**

(Publication No. 2590)\*

John Wesley English, Ph.D.  
University of Michigan, 1951

##### **Statement of the Problem:**

The purpose of this study is to provide a valid list of topics and field data which are essential items to be included in studies of school building need. This type of list is an essential tool for the average school administrator, constantly faced with shifting needs for school buildings. The object of this study is to synthesize the viewpoints of the different authorities into such a final list.

##### **Method of Investigation:**

A detailed, comparative analysis was made of six school surveys made since 1942. Three of these studies were building need surveys and three were comprehensive educational surveys which included a chapter on plant facilities. These particular surveys were chosen because they were made under the direction of educators who are acknowledged leaders in this field. The two types of surveys were selected to provide examples of (1) intensive, detailed studies

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\* Microfilm copy of complete manuscript of 270 pages, \$3.38.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-333.

of school building need, and (2) brief treatments of the salient factors to be considered in determining need. The essential topics were extracted from comparative summaries of these six surveys, made by the writer, and two composite, inclusive lists were compiled. One list dealt with topics to be studied while the other was concerned with data to be collected. Each list was then submitted to a jury of seventeen school plant planning specialists for evaluation. The jury members were selected on the basis of training, positions held, and demonstrated competence in the field.

The techniques of the more recent self-survey plan of determining need were examined by means of case histories of three such studies made during the last five years in the Michigan cities of Midland, Dearborn, and Flint. The self-survey emphasizes new procedures and often secures results not possible with the survey made by outside experts.

#### Results:

In the case of each questionnaire, ten of the seventeen jury members submitted answers in time to be tabulated. Each item was rated as essential, desirable but not essential, or not necessary. The final revisions of the list of topics to be studied and data to be collected were prepared from the items rated as essential by the majority of the jury members. Such a list represents a better judgment than a list prepared by a single person and should prove to be valuable to school administrators planning internal surveys of building need. The scope and inclusiveness of the problem precluded investigation of every related area.

#### Conclusions:

The following principles evolved from the study and the comments of jury members:

1. No single list of steps or procedures for a school building survey can be all-inclusive. The purpose of the survey, the audience to whom the report is addressed, and the characteristics of the community studied will all affect the nature of the document prepared.
2. The limitations of any survey of school building needs are so great that flexibility and expansibility should be stressed in school building design so that needs not anticipated at present may be readily met in the future.
3. Self-surveys involving school administrators, teachers, pupils, and groups of lay persons have definite advantages in informing the community regarding the needs of the schools. School plant planning specialists may be brought in to serve in a consultant capacity. Final responsibility and control rest with the administrator and board of education.
4. Planning for school buildings must be a continuous

process in many communities due to the rapid changes taking place. Integration of such planning with city planning is essential in such communities and is valuable in any community.

**THE TEACHER IN THE DRAMA  
AN ANALYSIS AND EVALUATION OF  
THE CHARACTERIZATIONS OF AMERICAN TEACHERS  
IN BROADWAY PRODUCTIONS FROM 1920 TO 1950**

(Publication No. 2504)\*

Andrew Hammond Erskine, Ph.D.  
New York University, 1951

The purpose of this study is to investigate the characterization of American teachers in plays produced professionally in New York City, and subsequently published, during the period from 1920 to 1950, and to compare these characterizations with the data on the traits of teachers obtained by educators and psychologists through scientific research.

The investigation is restricted to characters depicted as having actual classroom duties, all purely administrative personnel being excluded, as are teachers of other countries. Also excluded are teachers in professional schools and private schools devoted to the teaching of special skills.

To permit a clearer approach, the problem was divided into five parts.

1. To what extent have playwrights been accurate in their portrayals of teachers, and have employed those traits which research workers have found to be common in the teaching profession?

2. Have dramatists given teachers serious, sympathetic treatment and, in doing so, made them appealing figures?

3. Do the plays of the period reveal any significant changes from decade to decade in portraying teachers; and, if so, do the changes reveal increased or decreased understanding of the profession?

4. Does the study reveal any misconceptions commonly held about teachers?

5. What teacher-traits, commonly found in both plays and research studies and socially unacceptable in the American culture pattern, should be modified or eradicated if the general status of the profession is to be improved?

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\* Microfilm copy of complete manuscript of 178 pages, \$2.23.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-245.

The investigation was begun by determining what reasonably objective research studies had been done on the traits of teachers. Fourteen were located and, upon analysis, revealed that from 29 percent to 33 percent of the profession may be considered generally maladjusted. The teacher-traits revealed in them are: neurotic tendency, self-sufficiency, and dominance. The Bernreuter Personality Inventory was the most frequently used instrument in these studies.

A survey of the dramatic literature reveals that from 1920 to 1950 forty-six plays containing seventy-nine characterizations of American teachers had been produced on Broadway and subsequently published. Analyses of these characterizations reveal that these traits occur with the frequency indicated: general maladjustment—66 percent, neuroticism—51 percent, economic trouble—37 percent, dominance—34 percent, sexual tension—33 percent, inappropriate clothing—19 percent, and self-sufficiency—18 percent. It should be noted that self-sufficiency is the only one regarded as socially acceptable in the present culture pattern.

Scrutiny of the characterizations reveals that, although more than half are treated sympathetically and three-quarters are treated seriously, the portrayals do little for the status of the profession because too many of them seem maladjusted and helpless. Men teachers and college teachers, in general, fare better than women teachers and those of lower schools.

Of the three decades covered by the study, the period 1930 to 1940 is least favorable in characterizing teachers, while the last decade is, in general, the most favorable. In the first decade teachers served chiefly as minor characters.

In characterizing teachers, playwrights err not so much in the traits employed, but in exaggerating their rates of incidence. If the status of the teaching profession in America is to be improved it would be well to reduce the frequency of general maladjustment, neurotic tendency, and dominance in its members.

The investigation reveals the need for further study of teacher-traits employing modern instruments and larger, less selective samples. Also recommended are studies of teacher-characters in other entertainment media and the portrayal of other professions, like law and medicine, in the drama.



## EDUCATIONAL ADMINISTRATION FUNCTIONS OF THE DISTRICT CLERK IN NEW JERSEY

(Publication No. 2505)\*

Alfred Samuel Faust, Ed. D.  
New York University, 1951

The study has for its purpose the determination of the legal status and the analysis of the functions of the office of district clerk in New Jersey. It not only attempts to outline the sphere of authority in present practice, but an attempt was made to delineate a proposed relationship between this office and that of supervising principal compatible with sound educational principles of administration and efficient business management.

Present differences of opinion, as reflected in the opposing concepts of unit and dual control, are brought into sharp focus.

In appraising existing practice information is presented through a written questionnaire from 152 or 76 percent of the school districts in the state employing a district clerk and a supervising principal. Similar data also are included from 64 of the approximately 300 smaller districts which employ a district clerk but no supervising principal. Interviews with the district clerk and supervising principal of a selected district in each of the 21 counties of the state are used to validate the findings of the questionnaire and to obtain more candid on-the-spot reactions.

The study traces the evolution of the office from its early historical permissive and statutory phases to its present legal form.

While no specific pattern is drawn concerning the functioning of the office in all situations, there is a preponderance of evidence that the district clerk directs the business affairs of the system as a co-ordinate administrator in 89 percent of the districts surveyed. The exceptions are instances where the district clerk is responsible to the board in specific statutory duties but is subordinate to the supervising principal in the business operational functions. From the analysis of this inquiry into present practice and varied conditions surrounding the office, a number of statements of principles are formulated which include both agreement and divergence of opinions concerning the sphere of authority of the district clerk. The statements are submitted for judgment and comment to a jury of seven composed of professional educators and public school business officials.

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\* Microfilm copy of complete manuscript of 163 pages, \$2.04.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-246.

From the findings of the inquiry, the reactions of the jury and literature in the field, the author recommends that:

1. Future legislation be considered to amend the statutes defining the local organization of educational service on a unit control basis.
2. Present consideration be given by the State Board of Education to the enactment of rules requiring all operational business functions of the district clerk to be channeled through the office of the supervising principal.
3. The need for a full-time district clerk be approved by the Commissioner and the State Board of Education.
4. District Clerks be made eligible for membership in the Pension Fund.
5. No residential qualification in the district be required for the office of district clerk.
6. A board member be ineligible for the office of district clerk.
7. Minimum legal requirements of preparation for the office of district clerk be established.

#### **A HISTORY OF THE NEW JERSEY STATE TEACHERS COLLEGE AT TRENTON, 1855-1950**

(Publication No. 2507)\*

Glenn Everet Fromm, Ed.D.  
New York University, 1951

#### **The Problem:**

The purpose of this study was to investigate the development of the teacher-training program as it has evolved at the New Jersey State Teachers College at Trenton since 1855. Facts that characterized the history of the school and the policies and philosophy that have marked its evolution in relation to its (a) establishment and continuance, (b) support and control, (c) business management, (d) plant and facilities, (e) faculty, (f) enrollment, and (g) curriculum were determined.

#### **Historical Background:**

The State Teachers College at Trenton is the ninth oldest institution of its kind in the country, and has operated through ninety-five of the one hundred eleven years of public teacher education in the

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\* Microfilm copy of complete manuscript of 526 pages, \$6.58.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-248.

United States. It has consistently adhered to an enlightened program of teacher-training.

There was a need to make an inventory as to what the results of teacher education in New Jersey have been for the purpose of endeavoring to improve that service in the future.

#### Sources of Data:

The principle sources of data for this study were the (a) annual reports of the Board of Trustees, the State Board of Education, and the principals and presidents of the school, (b) minutes of the State Board of Education, (c) laws of New Jersey, (d) files of newspapers, the college paper and yearbooks, (e) catalogs and other school publications, and (f) interviews with former students, faculty members, and the two living presidents.

#### Selected Findings

##### Establishment and Continuance:

The legislature established the normal school on February 9, 1855, as an experiment for five years. It was made permanent in 1865. Three periods in the history of the school stand out. The first, 1855-64, was the period of organization under William F. Phelps; the second, 1889-1917, was an era of expansion under James M. Green; and the third is the period since 1930 under Roscoe L. West in which the school has developed into a four-year teachers college.

##### Support and Control:

Appropriations of \$5000 to \$132,000 annually were made to operate the normal school from 1855 to 1917. Model School tuition provided a large part of the operating funds during this time. The Model School was abandoned in 1917, and since that time all money has come from the State. Tuition was charged for the first time in 1932 by the Normal School.

The Normal School was originally controlled by its own Board of Trustees. In 1891 the Board was abolished, and control passed to the State Board of Education. Committees of this body controlled the school until 1926 when the Commissioner of Education was made the executive head of teacher education.

##### Business Management:

Much of the early financial success of the Normal School was due to the unselfish service of Elias Cook, Treasurer of the Board of Trustees. The boarding halls have always been operated apart from the school itself on a non-profit basis. The State never provided any money for their operation or maintenance, and it paid only a small part of the original cost of these halls. The business manager is now responsible for the operation of the entire plant to facilitate its educational function.

**Plant and Facilities:**

The Normal and Model Buildings were built on Clinton Avenue in Trenton by a group of citizens in 1855-57. Later, a similar group built the boarding halls. The State bought the property in 1865. The plant was enlarged and improved after 1889, but it was always inadequate to meet the demands placed upon it. The original plant was abandoned in 1930, and a new one was built at Hillwood Lakes. Owing to the depression and World War II, some of the buildings originally planned have never been built, and the new plant remains too small to accommodate all those who seek admission.

**Faculty:**

Outstanding men and women have served the school in the fields of administration and instruction, and they have provided leadership both in New Jersey and the nation. In 1950 the faculty numbered eighty-four. The professional training of the faculty has constantly improved, and now approximately 25 percent hold Doctorate Degrees. A tenure law became effective in 1945. A salary schedule, ranking near the top for similar schools, was adopted in 1949. The faculty is associated with those of the other state teachers colleges in promoting education throughout the State of New Jersey.

**Enrollment:**

The enrollment has consisted predominately of women. For many years men made up about 10 percent of the enrollment. Since 1930 the enrollment of men has grown to about 25 percent except for the war years. Enrollment reached 200 for the first time in 1873, and varied near that figure until 1890. Under Green's administration the student body grew to 600 in 1915. A total of 750 was reached in 1928, and 1932 saw 932 students in the school. With minor fluctuations it has remained near that figure. Lack of dormitory and classroom space has always placed a limit on enrollment.

**Curriculum:**

The first curriculum was two years in length, and was made up mainly of the subject matter needed to teach in elementary schools. An optional third year of work was added in 1871, but it remained essentially a two-year curriculum for those properly qualified at entrance. After 1889 all students were required to complete what had been the three-year curriculum. Higher entrance qualifications made this possible in two years for most students.

Green proposed a four-year curriculum in 1895, and in 1898-99 fourth year work was offered for those preparing for high-school teaching. This was one of the first four-year teacher-training programs in the country, and it was dropped in 1917 as premature. Two-year curricula thereafter constituted the school's program. The expansion of the curricula to three years began in 1918-1919, and



in 1925 the first four-year permanent curricula were established. The school received authority to grant a degree in 1925. All curricula were made four years in length in 1935.

A graduate program in elementary education was begun in 1947.

#### **Recommendations:**

A study of the history of an institution and the environment in which it exists inevitably suggests procedures and developments that should be undertaken in the future. The following significant changes suggest themselves with respect to the State Teachers College at Trenton.

The autonomy of the State Board of Education, the Commissioner of Education, and the administrative officials should be increased to the extent that policy making functions are not thwarted by others, for example, the state finance office. Greater freedom in business management should be given to the college to insure more efficient operation and the use of funds.

The plant should be expanded to provide more classroom and dormitory space to more adequately meet the demand for teachers in New Jersey.

Promotions in the professional rank of faculty members up to the limits imposed by the salary schedule should be made possible.

Provision should be made to train all adequately prepared students who desire admission. A home economics curriculum should be established. A graduate program in Business Education and such other fields as a thorough study justifies should be organized to supplement that in elementary education.

Provision for a limited number of electives in all curricula should be made so that individual interests and needs can be met more completely.

### **A FOLLOW-UP STUDY OF DOCTORAL GRADUATES IN EDUCATION, UNIVERSITY OF MISSOURI**

(Publication No. 2677)\*

Lloyd Lee Garrison, Ed. D.  
University of Missouri, 1951

This investigation was a follow-up study of the doctoral graduates in education from the University of Missouri. The purposes were (1) to make available information concerning the professional

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\* Microfilm copy of complete manuscript of 349 pages, \$4.36.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
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and educational background of these doctoral graduates; (2) to discover what professional duties and activities such graduates were engaged in and some of the problems they had encountered; and (3) to learn how doctoral graduates felt about their graduate training at the University of Missouri and some of the opinions they held on related issues.

Personnel reported on in the study included the 197 individuals who had received the doctorate in education from the University of Missouri since the first such degree was conferred in 1916 through the year 1950. Data were obtained from the official files and records of various University offices, from the graduates' dissertations, and from a printed information form. The inquiry forms were sent to 186 of the doctoral recipients. Completed forms were received from 182 or 97.85 percent of the persons available.

The data were analyzed and presented under seven major divisions, namely: some basic characteristics of the personnel; education and training; professional experience and employment; professional duties, activities, and responsibilities; appraisal of the graduate program; opinions on selected issues related to graduate work; and summary, conclusions, and recommendations based upon the findings of the study.

Some of the more pertinent findings of the study were the following:

1. As judged by the marked increase in the number of doctorates in education conferred in recent years, the preparation goal of more and more professional workers in this field is becoming the doctoral degree.

2. There is a pronounced trend toward doctoral candidates in education at the University earning the degree of Doctor of Education rather than that of Doctor of Philosophy.

3. Most of the doctoral recipients complete undergraduate training in educational institutions within the state of Missouri, with a sizeable percentage receiving baccalaureates from Missouri's five state colleges.

4. A large majority of the doctoral recipients receive the master's degree from the University of Missouri, and earn a major portion of their graduate credit at this institution.

5. A relatively small percentage of the recipients' graduate credit for the doctorate is earned in non-education courses.

6. Graduates have a rich background of professional experience at the time of receiving the doctorate in education at the University of Missouri.

7. A majority of these graduates are initially employed in college or university positions, with a general tendency for an increasing proportion to become employed in institutions of higher learning.

8. A large majority of the doctoral graduates in education from

the University are engaged primarily in teaching or administrative work, with most of them performing some combination of these or other professional duties.

9. Generally, these graduates do some professional writing for publication.

10. Doctoral recipients are active in professional and community organizations, both as to affiliations and speaking engagements.

11. Doctoral graduates in education generally are well satisfied with the graduate program at the University of Missouri.

12. Although these graduates are not unduly critical of their graduate training, their evaluations indicate that the following phases of the graduate program could be made more meaningful and effective: seminars; placement services; and graduate assistantships.

13. Many of these doctoral graduates would like greater opportunity for participation in actual situations and practical experiments during the course of their graduate training.

14. These graduates leave Missouri primarily because of better financial or professional opportunities in other states.

#### COLLEGE MATHEMATICS FOR THE GENERAL STUDENT

(Publication No. 2679)\*

J. D. Haggard, Ed.D.  
University of Missouri, 1951

Major Adviser: Ralph K. Watkins

##### Purpose:

To determine what mathematics is needed by the general college student, both in his school work and in certain out-of-school activities, and to make some comparisons between this mathematics and the usual college offerings to such students, as represented by adopted college textbooks in general mathematics.

##### Method of Research:

A synthesis was made of twenty-three research studies, reporting the mathematics used in an area pertinent to the general college student. This synthesis was then compared with the content of nineteen college level cultural general mathematics textbooks.

##### Summary:

1. A list of seventy-nine mathematical topics, and the number of studies reporting each, was determined in the synthesis.

\* Microfilm copy of complete manuscript of 193 pages, \$2.41.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-420.

2. Most of the mathematics reported as important by the twenty-three research studies is quite elementary in comparison to "traditional" college mathematics courses.

3. General college students who have successfully completed four years of high school mathematics could omit mathematics from their present curricula without serious handicap, if the needs of these students are accurately depicted by the synthesis.

4. Arithmetic is more useful to the general college student than any other of the branches of mathematics. Analytic geometry and calculus appear to be of little value to him.

5. The mathematics reported to be important by the synthesis of investigations compares well with that which Brown found to be important by obtaining opinions of over nine hundred college teachers of mathematics.

6. Only about one half of the important mathematics topics, as determined by the number of research studies listing the topic as important, appear as the important topics of the textbooks, as determined by the space devoted to their discussion.

7. Each topic listed as important by the research studies was discussed in one or more of the nineteen textbooks examined, but no one book treated all of the topics.

8. The more recently published textbooks are more nearly in agreement with the mathematics suggested by the synthesis, than are the older books.

9. There is little uniformity of subject matter content exhibited by the nineteen textbooks. On the average only two fifths of each two books discussed common topics.

10. General mathematics textbooks, both in subject matter and method of presentation, are tremendously influenced by the pattern set by the "traditional" mathematics courses.

#### Recommendations:

1. A test, based on the mathematics revealed by the synthesis, should be administered to all general college freshmen whose mathematical background is in question.

2. A college mathematics course, built from the topics indicated by the synthesis, should be available to the students found deficient by the above testing scheme, or to any student who for other reasons is known to be lacking in his mathematical competence and understanding.

3. The high school should provide the opportunity for prospective general college students to obtain ample work in mathematics.

4. Cooperative planning, among college faculty members concerned with the general education program, should be done. In particular, teachers of mathematics should plan their work with teachers in the other areas of the general education program.



5. Textbooks with content more nearly approaching that suggested by the synthesis of investigations should be written and published.

**CERTAIN OPINIONS AND PRACTICES IN SELECTED  
ELEMENTARY SCHOOLS AND THEIR IMPLICATIONS  
FOR GUIDANCE**

(Publication No. 2680)\*

Corinne Dorothy Harper, Ed. D.  
University of Missouri, 1951

Major Advisor: Dr. L. G. Townsend

**Purpose of Study:**

The major purpose of the study was to determine in selected elementary schools of Missouri and Iowa certain current practices and their implications for guidance.

**Research Technique:**

An information form was sent to all parts of the United States to persons associated with the education of elementary school children. The recommendation of procedures was determined by the responses on the 551 information blanks returned by superintendents of schools, elementary school supervisors, elementary school principals, psychologists, guidance specialists who work with elementary school children, college instructors who teach education courses to prospective elementary school teachers, parents of elementary school age children, and elementary school teachers. Whenever 50.0 percent or more of the total agreed on a procedure, it was considered as a recommendation.

A second information form was sent to superintendents in Missouri and Iowa with the request that they have elementary school teachers or principals check the present practices in their school. The 714 blanks returned were used to compare the practices of the two states on a percentage basis.

**Summary:**

1. The recommended procedures cover the areas of teaching procedures, materials, administrative adjustments, mental health through personal contacts and other influences, home-school-community relations, individual inventory, ways of evaluating a guidance program, and the training of teachers and principals.

\* Microfilm copy of complete manuscript of 273 pages, \$3.41.  
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2. The Missouri and Iowa schools participating in this study most commonly follow the recommendations in the following areas in the order listed: mental health through personal contacts, home-school-community relations, instructional materials, teaching procedures, individual inventory, mental health through other influences, and the training of teachers.

3. The recommendations are not generally practiced in the areas of administrative adjustments, other materials (such as chairs, tables, desks), and in ways of evaluating the effectiveness of the present elementary school guidance program.

#### Conclusions:

1. Superintendents, supervisors, principals, psychologists, guidance specialists, instructors of college education courses, parents, and elementary school teachers do not necessarily agree within their own group nor with other groups on which procedures may lead to the best possible adjustment of the child.

2. There are certain areas where the value of a procedure seems to be definitely established in terms of agreement.

3. Considering the total responses, there is little variation in the practices reported by the Missouri schools and those reported by the Iowa schools.

4. The curriculum content is generally organized according to the needs of the class as a whole rather than according to the need for considering individual differences.

5. Size of classes should be reduced where possible.

6. In order to care for the individual needs of children more adequately, more attention should be given the needs of all children in classroom living, subject matter, materials, equipment, school organization, and school policies, and teachers should have more access to the services of trained specialists for atypical children.

7. Home visitation and conferences with parents are the areas of home-school-community relations where it appears that schools should increase their practice.

8. More elementary teachers and principals need specific training in guidance of elementary school children.

9. More attention should be given to the development of an organized guidance program in the elementary schools, and to the evaluation of the progress of pupils under such a program.

**A FOLLOW-UP SERVICE OF TEACHER EDUCATION  
INSTITUTIONS  
A STUDY OF SPECIFIC DETAILS OF OBSERVATIONAL  
AND VISITATION PROGRAMS AND RELATED INDIVIDUALIZED  
SERVICES TO GRADUATES OF TEACHERS COLLEGES  
IN THE UNITED STATES**

(Publication No. 2508)\*

James Stuart Hobkirk, Ed.D.  
New York University, 1951

Follow-up for graduates of teacher-education institutions is vitally important to the institution, its graduates, and the public school, in regard to effective preparation for teaching and the successful adjustment of beginning teachers to this profession.

This study of observation and visitation of beginning teachers by college staff members, as one specific service, was undertaken because of the apparent lack of coordination between the colleges and the public schools in this particular aspect of teacher education.

Borne out by the study are these four major points: first, a follow-up service to graduates as beginning teachers is the responsibility of the teacher-education institution; second, observation and visitation of the beginning teacher by college staff members constitute one effective follow-up service; third, by careful planning, a program for the individual teacher-education institution is possible from the standpoint of expenditure of staff time and money; fourth, such a program of observation and visitation is now in effect in some teacher-education institutions and is favorably regarded by the others included in this study.

The sources of data concerning programs of observation and visitation were through: personal visits to a group of colleges along the eastern seaboard of the United States; the advice of an educational jury on basic principles; a questionnaire to selected colleges throughout the forty-eight states and the District of Columbia; and a questionnaire to a group of graduates who were suggested by the administrators of twenty colleges having programs of observation and visitation.

Findings in the study were as follows:

Literary references place the responsibility for initial adjustment of beginning teachers upon the colleges.

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\* Microfilm copy of complete manuscript of 115 pages, \$1.44.  
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The educational jury on basic principles subscribes to the importance of observation and visitation programs carried out by college staff members in cooperation with public school personnel as being fundamental.

Twenty colleges claim successful programs of this type.

Forty-seven institutions see programs of observation and visitation as a possible and practical factor in beginning-teacher adjustment.

Graduates of the twenty colleges who have worked with college staff members in their initial teaching were very enthusiastic concerning this service, and advocated closer organization and extension of such a program by the colleges.

One would conclude from the many indications of acceptance of all phases of the study that the idea of the college continuing its contact with graduates as beginning teachers is dependent only upon formulation of a plan to fit the circumstances in the local college.

The features concerning observation and visitation revealed through this study were incorporated in a suggested program adapted to local conditions for the State University at Potsdam, New York.

#### AN ANALYTICAL STUDY OF RELATIONSHIPS BETWEEN PUBLIC SCHOOLS AND OTHER TAX-SUPPORTED COMMUNITY AGENCIES

(Publication No. 2509)\*

Robert Luther Hopper, Ph.D.  
New York University, 1951

##### **Purpose:**

The purpose of this investigation was to analyze the relationships between public schools and other tax-supported agencies in selected communities and to discover the significance of factors such as number, scope, character, and cost of community services, for the administration and financial support of the public schools.

##### **Procedure:**

Through the use of seven criteria, eighteen cities throughout the United States were selected for study. These cities had populations from 10,000 to 25,000 and were similar in character for factors such as labor force, ability to support services, school population, area, and type of city. These eighteen cities were in eleven different states.

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\* Microfilm copy of complete manuscript of 116 pages, \$1.45.  
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Data were secured for this investigation through correspondence, published and unpublished official reports and audits, and inquiry blanks. The data collected included organization of government, specific services provided by each department, number of paid and volunteer workers, amount of expenditures for each service, and the number of persons in each program. All data were verified by personal visits to the cities. In addition to these data, other aspects of each community were summarized.

#### **Treatment of Data:**

It was found that in the cities studied, nine types of services usually were provided. These services were: administration, recreation, health, library, school, park, street and sanitation, fire, and police. For each of these services, a character rating scale was developed from the services in each community. Each rating scale consisted of four scale values as follows: (1) service not provided, (2) below average services, (3) average services and (4) above average services. Each of the nine services in the cities was placed in rank order according to the assigned scale value. Similarly, each of the nine programs in the cities was placed in rank order on the basis of per capita expenditures for services, number of workers per 1,000 population, and degree of centralization of city government.

The rank order method of correlation was employed to determine significant relationships between the various factors. The reliability of the relationships was determined by finding the standard error of each rank order correlation.

#### **Findings and Implications:**

Many conclusions may be drawn from this investigation. The four most significant were as follows:

1. A strong positive relationship in character existed among the services of each community. For example, if the character of one service was above average, all services in the community tended to be above average.
2. A positive relationship existed between the character of community services and per capita expenditures for them.
3. No significant relationships existed between expenditures for the various specific community services.
4. A slight positive relationship existed between the degree of centralization of city governments and the character of service.

From such relationships certain implications and recommendations for school administrators emerge. The outstanding implications would appear to be as follows:

1. Since the various community services tend to vary together, schools have a character similar to that of other services. Therefore, school administrators need to accept the responsibility of community leadership if the level of schools and communities is to be raised.

2. Community agencies must work together cooperatively in order to identify, attack, and solve community problems.

3. New ways need to be found for people in a community to identify, attack, and solve community problems.

4. Centralizing city government seems to have value; however, such centralization does not insure efficient services.

The resources for the improvement of local communities lie within each community. As relationships are understood and problems identified, communities must be prepared to act. The school administrator and his staff are in a position to assist the community in solving problems. Through such cooperative action it is reasonable to expect better school services for all members of the community.

### THE TRADITIONAL EUROPEAN SCHOOL AND EXPERIMENTS IN THE NEW EDUCATION

(Publication No. 2539)\*

Kalevi Simo Kajava, Ph.D.  
Columbia University, 1951

This study is divided into three parts. The first deals with the traditional European school. The description of the traditional school is based partly on my own experience as a child in a European school, and partly on relevant historical and educational literature. By the traditional European school, we mean the educational system which has its roots in the curriculum and the teaching methods of the medieval cloister and cathedral schools. Although the European schools have undergone many changes, certain features of this "old" educational pattern have continued to dominate European education down to the present time.

1. This traditional program is authoritarian and tradition centered. It represents a pedagogy from above, and it seeks to introduce the child to a predetermined system of moral values.

2. From the standpoint of its curriculum, the traditional school is a subject-centered school, and little attention is given to the actual physical and social environment.

3. Instruction in the traditional school is dogmatic and book-centered, and its emphasis on competition fails to nurture a sense of community.

4. The method of the traditional school is formalistic and mechanistic, based mainly on memorization; it is grounded in the principle of formal discipline.

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\* Microfilm copy of complete manuscript of 237 pages, \$2.96.  
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The second section is devoted to a critical analysis of the educational views of four pioneers in the "new education" of Europe: Hugo Gaudig (1860-1923), a German educational idealist; A. S. Neill (1895- ), head of the English experimental school at Summerhill; Ovide Decroly (1871-1923), a Belgian leader in scientific child study; and Georg Kerschensteiner (1854-1933), an eminent figure in the German "Arbeitsschule" movement. In this particular attention is given to the social, psychological, and philosophical presuppositions of these European educational leaders.

The concluding section explores the experimentalist philosophy and the educational ideas of Dr. John Dewey, the world's foremost leader in "the new education" movement of our period. The democratic and experimentalist views of this American educator are made the basis for the re-evaluation of contemporary educational practices in Europe.

This study emphasizes that the "new education" in America denotes something more fundamental than a new pedagogical device. It denotes an effort to work out a theory and practice of education in accord with the following developments in the life of Western man.

1. The evolutionary conception of experience as adjustment between organism and surroundings, and the view of mind as an instrument which facilitates this adjustment.

2. The pattern of thinking involved in scientific or experimental method.

3. The ethical meanings embedded in the democratic way of life.

4. The rise of industrial society with its application of science to the ways of living and of making a living.

5. A psychology of learning which views attitudes and habits as traits that develop in the process of adjustment.

It is the conviction of the writer that a program of far-reaching reconstruction in European education is long overdue. Europe will be crippled in its effort to adjust to the new world now in process of rapid development, so long as it seeks to nurture its young by the formal and authoritarian practices of the traditional school.

**EXPERIMENTAL TESTS OF PRINCIPLES  
OF DEVELOPMENTAL ANATOMY AND NEUROANATOMY  
AS APPLIED TO THE PEDAGOGY OF READING**

(Publication No. 2613)\*

Warren Andrew Ketcham, Ph.D.  
University of Michigan, 1951

The problem of this study is to evaluate a training program designed for the purpose of improving the reading skill of a group of boys, age seven to ten years. The training represents the application of a space-time frame of reference to language development and is based on the theories from developmental anatomy and neuroanatomy that: (1) phylogenetically and ontogenetically muscle precedes nerve and motor precedes sensory, (2) gross coordination of muscle and nerve precedes and is determinative of refinement of differentiation and integration, and (3) structure and function are interdependent and cannot be considered separately.

Thirty-two boys from four elementary schools of Ann Arbor, Michigan, were selected as subjects for the experiment. The most seriously retarded readers were selected on the basis of teacher judgment and the results of standardized tests. The children were divided into comparable experimental and control groups.

The plan of the experiment involved: (1) an initial inventory of growth status, (2) a period of training which was given to the experimental group and withheld from the control group, and (3) a final inventory of growth status.

The training program was administered individually to each child in the experimental group during two twenty-minute periods per week for sixteen weeks. During each interview the subject was given a series of exercises in: (1) posture; (2) breathing; (3) phonation; (4) articulation; (5) substitution of the secondary sensation of vision of symbol for fusion of the primary sensory perceptions of organic sensation, kinesthesia, hearing, and vision of movement; and (6) oral reading. Similar interviews were held with children of the control group. However, with the exception of a few minutes of oral reading, no training was given.

The viewpoint of the training program is that: (1) meaning is endogenous before it is exogenous, it is emergent from the total developmental complex, (2) comprehension of symbolic language is an emergence from movement and thus the beginning of integrated movement

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in the growing organism represents a forward reference to the beginnings of the language process, and (3) language is a function of the total organism.

Kymograph records of breathing movements were made during oral reading. Analysis of the records gives an inspiration-expiration ratio. It indicates the extent to which the child has achieved the short inspiration followed by a long expiration, so essential for oral language. Growth is indicated by a decrease in the size of the ratio. The control group showed an initial mean I/E ratio of 31.7 and a final of 32.9 while the experimental group showed an initial mean I/E ratio of 34.5 and a final of 22.2. During the same period, the control group showed a mean growth of one-half month in oral reading age and 3.6 months in reading age, while the experimental group showed a mean growth of 6.2 months and 9.9 months in the same aspects of language growth.

On the basis of the data of this study the following conclusions are tentatively given.

1. Learning to read is an emergence from a developmental continuum which has its beginnings in the basic vegetative movements of the organism.

2. The emergence of reading ability follows a time-space pattern which is marked by interrelated integrative levels commonly known as speech, oral reading, and silent reading. The pattern is kept intact by a continuous process of integration and differentiation.

3. Readiness is more a function of the degree of integration of total growth than of the quantity of total growth.

4. Breathing patterns are an effective means of inventorying the biological levels of language development.

5. Extended experience in oral reading represents a definite language need for many children.

6. Deprivation in language development are very possible at early levels through violations of the limitations of variability in the time-space pattern from which language emerges.

7. The possibility of stimulating growth in terms of increased tissue does not seem likely or desirable, but the further integration and differentiation of growth is often possible and is determinative of achievement within the organism's capacity.

8. The training program of this study suggests one methodology for effecting integration and differentiation of growth within the space-time pattern of emergence of language development. It is the responsibility of psychological and educational research to explore the possibilities of present methods as well as to discover new methods which will serve to supply the same needs for language development among growing children.

## AN ANALYSIS OF SOCIAL REJECTION IN A COLLEGE MEN'S RESIDENCE HALL

(Publication No. 2491)\*

John William Kidd, Ed. D.  
Michigan State College, 1951

### The Problem:

If education is geared to the development of the whole person, there are fundamentally two aspects of the individual with which an educational institution should concern itself. Traditionally its concern has been primarily devoted to the academic aspect; increasingly educators seem to be turning their attention to the other phases of personality development which may be termed the other aspect, the social aspect of the person, the adjustment and adjustability of the person to individuals and groups with whom he is in contact.

Based on the proposition that a high degree of acceptability to one's peers is educationally desirable, this study has attempted, and to some extent succeeded, in identifying and analyzing some factors which were significantly associated with a group of 96 male college students living in a men's residence hall at Michigan State College. It had been determined that these 96 had the lowest acceptability status to the others in the group of 639 of which they were a part.

### Methodology:

A sociometric type questionnaire was used in which each individual was asked to name: (1) his best friend(s); (2) those he would be most reluctant to accept as friends with reasons; (3) the most and least preferred individuals to serve as Resident Assistant in his section; and (4) the most and least preferred individuals to serve as representatives to a conference of delegates from men's residence halls. He was also requested to supply a considerable amount of personal data. Each individual was assigned a rating score equal to the number of positive minus the number of negative friendship votes. The top 102 were then compared with the bottom 96 in regard to various characteristics as revealed by the data secured in the questionnaire, factual data secured from other sources, ratings by themselves on certain behavioral traits, and ratings by their Resident Assistants on those same traits.

### Conclusions:

In the group studied it may be stated that rejection, as opposed to high acceptability, was significantly related to: (1) being a foreign

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national; (2) having low marks as related to ability; (3) being a lower classman; (4) stating in confidence that one's family income is unknown; (5) being rated low on leadership and prestige by one's peers; (6) expecting relatively few to select one as a best friend; (7) naming few others as best friends and/or as individuals one would be most reluctant to accept as friends; (8) relatively little participation in spectator or extra-curricular activities; (9) doing no part-time work; (10) frequently moving one's residence or dropping out of school; (11) rating oneself low on participation in dormitory affairs, and on social and personality adjustment; and (12) being rated by student leaders as relatively low on participation in dormitory affairs, over-all social participation, and social and personality adjustment.

In addition to thus defining the role of rejection, it may be concluded that: (1) rejection is associated with background factors which deviate sharply from the group norms; (2) rejection is largely a matter of behavior which leads others to describe the reject as ego-centric, aggressive, inconsiderate, and, to a lesser extent, immature, withdrawing, and exhibiting feelings of inferiority; (3) the behavior of the reject, as indicated in (2) above, is typical of reactions to insecurity and frustration, i.e., aggression and/or withdrawal; and (4) since rejection is largely a matter of behaving in ways which fail to meet group approval, the reject is ineffective in taking on the roles of others so as to comprehend their expectations and/or fails to conform adequately to the group definition of acceptability.

#### ARTS ACTIVITIES INTEGRATED WITH THE TEACHING OF READING, SCIENCE, AND ARITHMETIC IN THE ELEMENTARY SCHOOL

(Publication No. 2685)\*

Richard Charles Kohler, Ed. D.  
University of Missouri, 1951

##### Purposes of the Study:

The purposes of this study were: (1) to ascertain the arts activities textbook writers recommend using in the teaching of reading, science, and arithmetic at the various grade levels of the elementary school; (2) to make a critical analysis of the types of arts activities the textbook writers recommend being integrated with the teaching of reading, science, and arithmetic; and (3) to present and interpret the findings in as helpful a way as possible for all

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persons interested in the professional preparation and advancement of elementary teachers.

#### Sources of Data:

The data for this study were secured from (1) an analysis of ten series of teacher's guidebooks—four series in reading, three series in science, and three series in arithmetic—for grades one through six, (2) literature on present day practices and procedures followed currently in elementary schools, and (3) literature on the use of the arts in the elementary schools. The series of textbooks, grades one through six, with the greatest sales by the Missouri State Teachers Association; and those named most often by school administrators in the State of Illinois were considered representative of those used in the elementary schools.

#### Summary of Significant Findings:

In analyzing teacher's guidebooks in reading, science, and arithmetic, it was found that thirty-seven different types of arts activities were recommended for integration with the teaching of these subjects in the elementary school.

Thirty-four types of arts activities appeared in the teacher's reading guidebooks, grades one through six; twenty-five types appeared in the teacher's science guidebooks and fourteen types appeared in the teacher's arithmetic guidebooks.

The thirty-seven different types of arts activities were distributed by grades as follows: thirty-three, grade one; twenty-eight, grade two; twenty-nine, grade three; twenty-three, grade four; twenty-three, grade five; and twenty-five, grade six. Eighteen types of arts activities were common to each of the six grades. Eleven types of arts activities were common to each of the three areas of the curriculum analyzed. Nine types of arts activities appeared exclusively in the reading programs and three types appeared exclusively in the science programs, whereas none of the types of arts activities appeared exclusively in the arithmetic programs.

The distribution of two and three dimensional arts activities remained relatively constant through the grades for all areas of the curriculum analyzed. The number of different types of arts activities which appeared in the teacher's reading and arithmetic guidebooks tended to diminish as the grades in school progressed. The number of types of arts activities which appeared in the science programs tended to remain relatively constant through the grades. The frequency of appearance of the arts activities decreased as the grades in school progressed.

#### Conclusions:

The data seem to support the following conclusions concerning the current use as well as the use which can be made of arts activities in elementary reading, science, and arithmetic.



1. A much greater variety of different types of arts activities are or can be successfully integrated with the teaching of reading and science than with the teaching of arithmetic in the elementary school.
2. A greater number of different types of arts activities are or can be integrated with the teaching in the primary grades than the remaining grades of the elementary school.
3. Arts activities are or can be used more often in the primary grades of the elementary school than in the remaining grades.
4. Three dimensional types of arts activities are or can be integrated with the teaching of science to a greater extent than two dimensional types of arts activities.
5. Both two and three dimensional types of arts activities are or can be integrated with the teaching of reading.
6. Two dimensional types of arts activities are or can be integrated with the teaching of arithmetic to a far greater extent than three dimensional types of arts activities.
7. Many types of arts activities are common to and can be integrated with the teaching in each grade of the elementary school.
8. Many types of arts activities are and can be integrated with more than one area of the curriculum. A large number of different types of two dimensional arts activities are common to all areas of the curriculum analyzed.

**EVALUATION OF ACHIEVEMENT AND COMPARISONS  
OF ACHIEVEMENT IN FIRST YEAR ALGEBRA OF PUBLIC  
HIGH SCHOOL STUDENTS GROUPED ACCORDING TO THEIR  
MATHEMATICAL BACKGROUNDS AND INTERESTS**

(Publication No. 2614)\*

Robert Stanley Lankton, Ph.D.  
University of Michigan, 1951

The purpose of this study is to examine the effectiveness of the first year algebra part of the secondary school mathematics curriculum and program of instruction. The study is undertaken in the light of the responsibility of mathematics teachers, guidance personnel, and curriculum workers to provide mathematical training to meet the needs of all students.

Achievement in first year algebra is measured by means of a new test prepared by the writer with the aid of Cooperative Test Division of Educational Testing Service. The test is designed to measure the

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outcomes of instruction in first year algebra defined by specific objectives prepared for this investigation. The objectives are validated by the literature on the teaching of mathematics and by a jury of specialists in mathematics education.

The algebra test, along with a student inquiry form, was administered to students in representative high schools that were selected on the basis of size and geographical location within the state of Michigan. The student inquiry form was designed to secure information concerning the students' mathematical backgrounds and educational and vocational interests. Responses to the test and inquiry form were received from 1,147 students in all grades of the senior high school.

Small or exact sampling statistical theory is used throughout the study. The question of normality of the distributions of algebra achievement scores obtained by students classified in eight basic groups is thoroughly discussed by means of the chi-square test and moments test of normality. The distributions of the parent populations are characterized by exhibiting estimates of the first four central moments with fiducial limits set at the 95 percent confidence level for the mean and standard deviation. Analysis of variance and the Student-Fisher  $t$  test are used to test the significance of the difference between group means.

There are many collations of the data to test the null hypothesis that there is no significant relationship between ability in first year algebra and the mathematical backgrounds and interests of high school students. Some of the results are as follows: Ninth graders are superior in mean achievement at the 1 percent probability level to all other groups of students except those whose mathematical backgrounds include a course in advanced algebra. Senior students who have studied a course in general mathematics are superior to those with comparable backgrounds except for the general mathematics course. Interest in mathematics is very closely associated with mean algebra achievement.

On the whole, competence in first year algebra is extremely low. The data indicate very poor mastery of algebraic principles and processes on the part of a large proportion of the students. When choices of future vocations are considered, it is clear that too many students are studying traditional algebra and sequential mathematics courses when other courses geared to the requirements of general education would be better suited to their needs.

EDUCATIONAL NEEDS AND INTERESTS OF YOUTH  
AND ADULTS OF MOBERLY, MISSOURI

(Publication No. 2686)\*

Marion Errol Maddox, Ed. D.  
University of Missouri, 1951

Major Adviser: H. H. London

**Purpose:**

To ascertain the entry job opportunities for youth in Moberly, and the educational needs and interests of youth and adults; to evaluate the present educational program of Moberly Junior College in terms of opinions of respondents; and to suggest additions and changes for the improvement of the present program.

**Sources of Data:**

An entry job survey of Moberly, Missouri; facts and opinions from former students of grades twelve and fourteen for the school year 1946-47; facts and opinions from students currently enrolled in Moberly Junior College; opinions of adults in the community; permanent records of Moberly Public Schools; records from the Vocational Education Division of the State Department of Education.

**Summary:**

At the time of the study, there were 1317 beginning jobs in Moberly. These jobs were: professional, 21; sales and kindred, 170; clerical and kindred, 275; service, 191; agriculture, 3; skilled, 109; semi-skilled, 351; and unskilled, 197. Of the 1317 beginning jobs 295 or 22.4 percent were part-time jobs.

Over three-fifths of the former students involved in this study were residing in Moberly at the time of the study.

Over two-fifths of the former students were married and about half of that number had children.

The job classification in which the largest number of working former students were employed was clerical; over three-tenths of them were employed in these occupations. Over one-fourth of them were not in the labor market.

Approximately one-fourth of the former Junior College students were attending other schools. The majority of these former students were preparing for professions.

Of the subjects taken in Moberly Junior College, the five which were considered most helpful were: "On the job," office machines,

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auto-mechanics, bookkeeping, psychology, and general business; "In everyday life," geography, English, hygiene, auto-mechanics, and psychology; "In other schools," calculus, physics, trigonometry, and zoology.

Over two-fifths of the former students indicated that they would attend adult classes if they were offered.

Of the 305 students currently enrolled, approximately two-fifths were taking general courses, three-tenths college preparatory courses, and three-tenths vocational courses.

Students currently enrolled were most interested in commerce, fine arts, trades, science, health and hygiene, and social science as electives.

Those students who planned to attend other schools designated 20 different colleges as their choices.

Students' occupational choices did not compare favorably with parents' occupations or with local and national job opportunities.

Respondents indicated that certain courses in vocational, general and technical education should be added to the Junior College curriculum.

Adults indicated an interest in a wide variety of general and vocational adult classes as additions to the Junior College program.

#### Conclusions:

The major educational functions of the Moberly Junior College, it would seem, are: education for living in the community, state, and nation; education for work; education for transfer purposes.

The addition of certain general, technical, and vocational courses to the Junior College program would augment the facilities of the college for meeting the educational needs and interests of the community.

The youth of Moberly Junior College need more educational and occupational information and information concerning their abilities in order to make wise occupational choices and to prepare for careers.

If the college accepts the challenge and responsibility of adult education in vocational and general fields, it must expand its educational program for adults.

It seems that adults of Moberly desire, and are willing to pay for an educational program which functions throughout the year and which will meet the educational needs of the community.



## THE STATUS OF THE PUBLIC SECONDARY-SCHOOL PRINCIPAL IN MISSOURI

(Publication No. 2687)\*

Harold Wallace Massey, Ed. D.  
University of Missouri, 1951

Major Advisor: Dr. John Rufi

### Purpose of Study:

To describe the status of the public secondary-school principal in Missouri, with special emphasis on determining the extent to which the position has been professionalized.

### Research Technique:

The data which form the basis for this study were obtained from returns of information blanks which were sent to all public secondary-school principals in Missouri, under cover letter of the State Department of Education.

### Major Findings and Conclusions:

1. Purposeful planning by most of the principals in their undergraduate days is evidenced by the disclosure that more than one-half of them majored in education and more than three-fourths of them had selected some phase of work in the field of education as their life's career.

2. Those professional courses which are organized and adapted especially to meet the needs of incumbent or potential administrators have apparently been of greater value than other education courses to the principals in discharging the duties incident to their positions.

3. It appears that many principals feel keenly their inadequacy when it comes to public speaking and the use of other communicative skills, and would emphasize these arts in further preparation for the position, along with guidance and additional work in administration and supervision.

4. Most of the principals have a rather extensive background of teaching and administrative experience, as well as considerable academic and professional preparation for the position.

5. A fairly-high degree of stability in the principalship is evidenced by the information that many of the individuals own their homes and plan to continue as high-school principals.

6. A disproportionately-small percentage of the school day is devoted to the supervision and improvement of instruction by

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practically all of the principals in the light of the generally-conceded assumption that this is their most important function.

7. Most of the principals in the smaller schools are so overburdened with classroom teaching duties that they have little or no time to devote to important supervisory and administrative duties.

8. Many of the principals are delegated neither final nor assist degrees of authority in connection with such important functions as the selection of teachers, the selection of textbooks, and the supervision of custodians and buildings.

9. A majority of the principals have their administrative and supervisory duties defined by mutual agreement with the superintendent of schools. In general, those having such duties defined by the rules and regulations of the board of education are heading the larger schools. In several instances, the principal's administrative and supervisory duties are not clearly defined.

10. The areas in which the principals consistently encounter their most difficult problems tend to vary greatly among the schools. Considered separately, the heads of larger schools find their most consistent perplexities in connection with the supervision and improvement of instruction, conceivably because they devote more time and attention to it than do the principals of the smaller schools.

11. Most Missouri high-school principals' salaries are not adequate to maintain what they consider to be a reasonable living standard for their families.

12. Principals of the larger schools tend to be older men, receive higher salaries, and have more academic and professional preparation, more administrative experience, and better tenure than do the others. Furthermore, these men tend to hold most of the special state principals' certificates, devote proportionately-larger amounts of the school day to supervisory and administrative duties, do little or no teaching, and show more professional interest and growth, as evidenced by doing more professional writing and belonging to more professional organizations.

## THE RELATIONSHIP BETWEEN THE READER'S ATTITUDE AND CERTAIN TYPES OF READING RESPONSE

(Publication No. 2543)\*

Anne Selley McKillop, Ph. D.  
Columbia University, 1951

### Problem:

The investigation was designed to explore the relationship between the reader's attitude toward a topic and his responses to different types of questions about reading passages dealing with that topic.

### Procedure:

Each of 512 eleventh grade students was given the following tests: (1) Likert type attitude scales toward Negroes, Communism, and Israel, (2) a twenty-word vocabulary test used as a measure of verbal intelligence and general information, (3) a reading test on one of the topics (Negroes, Communism, or Israel).

Each reading test consisted of three passages — one favorable, one unfavorable, and one unrelated to the topic. The unrelated passage, about Switzerland, common to all tests, was always placed between the two "topic" passages, and the test on it provided a measure of general reading ability. The six multiple-choice questions on each of the "topic" passages included one or two requiring recognition of specific statements made in the passage, two or three requiring inferences on the basis of the passage, one asking for a judgment beyond the passage, and one asking for a choice of title for the passage. The possible choices for each question included at least one which was favorable to the topic and at least one which was unfavorable to the topic. For the detail and inference questions, one possible choice was "correct"; for the judgment and title questions there were no "correct" foils.

Students were asked to choose from a list the three adjectives which they considered best characterized the author of each passage. They were also asked to write the one thing which had impressed them most out of the test.

Point biserial correlation coefficients were computed between choice of each foil of each multiple-choice question on each of the passages in each test and vocabulary score, Switzerland score, and attitude toward each topic. The effects of the abilities represented by scores in vocabulary and general reading was controlled by the use of partial correlation coefficients.

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**Findings:**

Half of the thirty-six multiple-choice items showed at least one foil significantly related to attitude. The number of items with at least one foil significantly related to attitude increased from very few on the detail questions, through an increasing number on the inference questions, the judgment questions, and the title questions, to almost all the adjectives. For the adjective, title, and judgment questions the difference between the means of all the correlations of attitude and choice of favorable foil and attitude and choice of unfavorable foils was significant. For the inference questions such differences approached significance. For detail questions there were no differences.

Results indicate that the relationship between attitude toward a topic and response to reading passages dealing with the topic depends, in part, on the kind of reading response. Responses which are primarily evaluative are most closely related to attitude.

On the whole, eleventh grade students were able to distinguish their comprehension from their evaluation under the task set of a reading test, where the set to look for the "right" answer is strong. It is reasonable to suppose that in other situations where this set is less strong, reading responses may be more evaluative, and, hence, more affected by attitude.

**AN INVESTIGATIVE STUDY TO DETERMINE  
THE LEARNABILITY OF SELECTED SCIENCE UNITS  
FOR GRADES VII AND VIII**

(Publication No. 2689)\*

Sister Mary Hugh McLarney, C.S.J., Ed. D.  
University of Missouri, 1951

Major Advisor: Dr. C. A. Phillips

**Purpose of Study:**

The major purpose of the study was to design a pattern for the teaching of selected science units and to determine the learnability of the units taught. The study involved the following questions:

1. What percent of learnability accrues from the teaching of each unit and what is the time in weeks required for the learning of each unit?
2. What is the apparent effectiveness of a non-textual, wide reading program in the learning of science?

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3. What extent of gain in reading ability results from a wide reading science program?

4. Is there a significant difference in the achievement attained in a single-grade as compared with a double-grade learning situations?

#### Method of Procedure:

The investigation was an instructional problem utilizing the one group method of technique in a general classroom situation. The personnel of the study included 100 students from each of Grades VII and VIII under the guidance of seven teachers in both single- and double-grade classroom situations. The grades involved comprise the upper grades in an elementary system operating on the 8-4 plan of organization and in which no formal teaching of science prevails in Grades I-VI. Appraisal of growth was obtained by comparison of results of preview and review tests administered before and after the study of each unit. Evaluation of general science achievement and reading ability resulting from the study as a whole, was determined by initial and final administrations of comparable forms of standardized science and reading tests. Investigator and teachers mutually devised flexible guides for learning of science in a nontextual unit program with no predetermined time limits. The units were entitled: Unit I - Light, Heat and Fuel; Unit II - Food; Unit III - Communication. Both grades pursued the same materials and procedures.

#### Summary:

Findings emanating from the study procedure and forming the basis of resulting conclusions are summarized as:

1. The subjects were of normal chronological age, with medians of 12 years, 4 months and 13 years, 5 months for Grades VII and VIII respectively.

2. The subjects were more than a year above average in mental age with median mental ages of 13 years, 6 months for Grade VII and 14 years, 9 months for Grade VIII, and with median I.Q.'s of 110.5 and 110.7 respectively.

3. The personnel of both grade groups at the beginning of the study were more than a year in advance of the expected norm in reading ability, having grade-equivalent norms of 8.3 and 9.3 respectively for Grades VII and VIII as measured by the Stanford Reading Test, Form D and made gains of 8 and 7 months respectively as measured by Form E of the same test at the conclusion of the study.

4. Commendable initial status and subsequent improvement in reading was evidenced by advances from the 48th to 76th percentile for Grade VII and from the 51st to the 78th percentile for Grade VIII on Part III of the Cooperative Science Test which consists of interpretation and comprehension of science content.

5. The range of mean percentages of material previously known to the students, as measured by preview unit tests ranged from 19 to 35 percent with a median of 28 percent and thus did not vitiate the opportunity for learning the designated material.

6. As a result of the science unit study Grade VII achieved mean learnability gains of 42 percent, 48 percent, and 53 percent for Units I, II, and III respectively; Grade VIII obtained mean learnability gains of 44 percent, 46 percent, and 53 percent respectively for the same Units.

7. Total learnability for the Unit material showed increasing final means from Unit I to III as: (1) Grade VII - means: 61 percent, 75 percent, 81 percent; (2) Grade VIII - means: 69 percent, 82 percent, 82 percent.

8. Growth in science achievement over the twenty-four week period of study as measured by the Cooperative Science Test, Forms S and X, administered at the beginning and at the end of the study revealed substantial gains as follows: Grade VII advanced from an initial median approximating the test's 15th percentile for Grade VII to a median approximating the test's 50th percentile for Grade VIII; Grade VIII advanced from an initial median approximating the test's 23rd percentile for Grade VIII to a median score representing the test's 50th percentile for Grade IX.

9. Time requisite for the learning of the units as outlined in the study approximated the following allotments: Unit I, 10-12 weeks; Unit II, 6 weeks; Unit III, 8 weeks.

10. A very significant difference was found between mean learnability gains for the single- and double-grade situations for Units I, II and III as measured by the Unit tests. The single-grade learning situation showed highest means in all instances.

11. No significant difference was found between mean learnability gains accruing from the single- and double-classrooms in general science achievement as measured by the Cooperative Science Test.

12. Both grades revealed deeply significant gains in the areas of (1) Facts, Skills and Applications, (2) Terms and Concepts, (3) Interpretation and Comprehension. The least gain occurred in knowledge of terms and concepts. Critical ratios ranged from 10 to 25.

#### Conclusions:

The findings of the learning study justify the following conclusions:

1. The instructional procedure in a nontextual wide reading program is effective in the learning of science at the seventh- and eighth-grade levels.

2. The units, as developed in this study, are for the most part, suitably placed in either Grade VII or VIII.

3. The time required for the teaching of the three units approximates twenty-four weeks.

4. A nontextual, wide reading program is conducive to improvement in reading ability.

5. Significantly increased learnability results from a single grade as opposed to a combined-grade learning situation in the unit program of science.

### THE HISTORY AND DEVELOPMENT OF THE TEACHING OF ENGLISH IN CHINA

(Publication No. 2546)\*

Poon-Kan Mok, Ph. D.  
Columbia University, 1951

The purpose of this study is to trace the history and development of the teaching of the most important subject — namely, English — in Chinese schools and higher institutions of learning during the last hundred years. The intention is two-fold: to study the place and the reasons for the place of English teaching in schools and colleges throughout the period covered, and to use English teaching as a barometer to register the changes in the political, diplomatic, social, economic, educational, cultural atmosphere of the last hundred years. It is essentially the telling of the story of the teaching of this all-important subject with the forces shaping modern China as the background; so that while the light is focused on the story, enough light is thrown on the history of missionary-sponsored education in China, on the history of modern education, on China's attempts to strengthen itself, on the growth of nationalism, on the history of modernization and on China's cultural relations with the West.

The method employed is historical throughout. The sources of material are largely primary in the form of official histories, draft histories, memorials and other writings of important officials at the helm of state in the various periods concerned, missionary reports, official reports, decrees and other government papers, textbooks for the various periods, etc.

The history of the teaching of English in China has been inseparably connected with the history of modern education in that country. This is not surprising when it is realized that Great Britain and the United States have exerted the greatest influence on modern China, and therefore their language has been the chief carrier of modern goods and ideas to China.

English was considered by early missionary educators — and many a modern one — as a handmaiden of Christianity, a "liberator"

\* Microfilm copy of complete manuscript of 294 pages, \$3.68.  
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of the "Chinese mind," the key to the rich storehouse of things and ideas Western, to the dispensation of which they devoted their lives. It was the most important subject, if not synonymous with modern education — as it was in many cases — in the modern schools established by the Chinese between 1860 and 1898. In this period, it was the Open Sesame to the secret of power demonstrated by the Western nations — a national power to the achievement of which China devoted all her energy. It was given more time and emphasis than any other subject in the 1905 and 1912 curriculums. In the first, which marks the first modern school system in China, English was the bridge across which scientific, technological and even political ideas were to come into China to make her "modern." In the second, which marks the first school system under the Republic, English was considered a kindred link between the new Republic and her older sister democracies in the West. It was not until the 1920's when Chinese education was gradually coming into maturity that the position of English was put on the same level with Chinese in the high schools and the first two years of college. From the twenties to the defeat of the Nationalists in 1949, when thoughtful educators were trying to make Chinese schools and higher institutions experimental stations for the fusion of Chinese thought and life with Western democratic thought and life, English was considered the most effectual catalyst.

Thus, the teaching of English has been inseparably connected with the major movements in the life and thought of China in modern times. The usual aims of foreign language teaching in other countries — aims commercial, social, disciplinary, personal-cultural — have been only secondary in the teaching of English in China. English teaching in that country has always had a high mission to perform. It has been believed that the knowledge of English and what is learned through it would be a definite contribution to the making of an independent, prosperous, strong, modern China. The national and cultural value — always with the nation kept to the fore as the chief beneficiary — is what has made the teaching of English in China so different from foreign language instruction in other countries. And it is this difference that makes the study and its contribution significant.



## THE MATHEMATICS OF GENERAL EDUCATION FOR THE TEACHER

(Publication No. 2627)\*

Vesper Dale Moore, Ed. D.  
University of Michigan, 1951

### The Problem:

The purpose of this investigation was to identify the concepts, principles, and skills in mathematics that should be included in the general education of teachers in non-technical fields.

### The Techniques:

Data, secured from administering two tests to college freshmen at Indiana State Teachers College, were analyzed. Eight hundred eighteen freshmen preparing to teach in non-technical fields were given the Hundred-Problem Arithmetic Test by Schorling, Clark, and Potter, and 328 took the Test of Functional Competence in Mathematics by David John Davis.

A tentative list of mathematical concepts, principles, and skills that might be suitable for inclusion in the general education of teachers in non-technical fields was developed. The Check List published by the National Council of Teachers of Mathematics was first analyzed for the purpose of allocating its 29 items to the 3 categories, concepts, principles, and skills. The items in these categories were then supplemented with others that the investigator arbitrarily selected from 32 courses of general mathematics currently located in teacher education institutions in 21 different states. This final list was submitted to 4 specialists for further criticism and editing. The list revised by the investigator on the basis of all the suggestions received included 410 items.

The list of mathematical concepts, principles, and skills was submitted to 5 specialists in the teaching of mathematics who were requested to evaluate each item on a point scale indicating its value for the general education of teachers in non-technical fields. The combined judgments of the specialists were assumed to be the values of the respective items.

### Conclusions:

1. A comparison of the competencies of a sampling of college freshmen at Indiana State Teachers College with the populations whose scores had been used in determining the norms of the Hundred-Problem Arithmetic Test and the Test of Functional Competence in Mathematics

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\* Microfilm copy of complete manuscript of 168 pages, \$2.10.  
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indicated that the performances of the college students were significantly better than the performances of the twelfth grade populations, but the scores of the college freshmen indicated a wide variation in their competencies, and thus indicated the need for further remedial teaching.

2. There is a substantial and definite list of mathematical concepts, principles, and skills determined from this investigation that should be included in the general education of teachers in non-technical fields.

### **FACTORS INFLUENCING THE PASSAGE OF FEDERAL LEGISLATION FOR VOCATIONAL EDUCATION**

(Publication No. 2691)\*

Jack Ward Morgan, Ed. D.  
University of Missouri, 1951

Major Advisor: Dr. H. H. London

#### **Purpose of Study:**

To ascertain the economic-social-philosophical factors, insofar as they were evident in the literature on the subject, that have been significant or controversial in the enactment of Federally aided programs of vocational education of less than college grade in the public schools.

#### **Research Technique:**

The historical method was used. Data were gathered from official publications of national educational, agricultural, labor, manufacturing organizations and Congressional records, hearings and reports. Also perused were reports of State Commissions and other books, studies, and writings pertaining to the laws concerned.

#### **Summary:**

1. The initial movement for vocational education, on both State and national levels, came about as an attempt to provide an education better suited to the needs of the masses of boys and girls.

2. The enactment of the Smith-Hughes Law represented an effort, by organized groups of citizens with definite ideas regarding vocational education, to promote the embodiment of those ideas in educational practice.

3. The most persistent and driving force promoting the Smith-Hughes Act was the National Society for the Promotion of Industrial

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Education. Also giving strong support to the movement was the American Federation of Labor and various agricultural organizations. Traditional educational leaders exerted little force in the passage of the act.

4. Important in the passage and writing of the Smith-Hughes Act was the waning popularity of faculty psychology and the emergence of a mechanistic psychology which gave support to specific training and transfer based on identical elements.

5. An essential factor in obtaining Federal legislation is the presence of strong and vigorous leadership on the part of influential Senators and Congressmen. Proposed laws must also receive strong support from State and national organizations concerned with the movement as well as Congressional committees considering the bill.

6. Since its formation in 1926, the American Vocational Association has been concerned primarily with holding and obtaining Federal legislation for vocational education. The Association has also been able to consistently gain and hold the friendship and support of influential members of Congress.

7. Throughout the history of vocational education laws, nationally organized agricultural groups have consistently supported programs of vocational education and have been influential in the enactment of the various laws.

8. Early bills passed by Congress tended to be simple, specific, and provided a minimum appropriation. Subsequent laws have gradually broadened the scope of vocational education and increased the funds available.

9. Attempts to provide additional funds to further develop the program of vocational education have usually been during periods of national emergency or economic and social crises.

10. Congress, has for the most part, been satisfied with the results of Federally aided vocational education and friendly toward proposals for its further development. Opposition that has arisen has usually been limited, local in character, and generally concerned with constitutionality or invasion of States rights.

#### **Implications:**

In the light of past history it is reasonable to expect requests of Congress to further expand the program of vocational education. Future legislation should expand present programs as well as include new fields of vocational endeavor. The legislation should also be more liberal in interpretation and made more flexible to provide for increased adaptability in meeting varying social-economic conditions throughout the nation.

## INSTRUCTIONAL PROCEDURES IN MISSOURI COLLEGES AND UNIVERSITIES

(Publication No. 2692)\*

Gaylord Dean Morrison, Ed. D.  
University of Missouri, 1951

Major Adviser: Dr. Ralph K. Watkins

### Purpose:

To determine the instructional procedures used in Missouri colleges and universities.

### Method of Research:

The data were obtained from 1688 college teachers in Missouri institutions of higher learning. These teachers reported, by the use of an information form, the instructional procedures they used under actual teaching conditions and the procedures they would prefer to use under ideal teaching conditions.

### Conclusions:

1. A considerable variation in the type of procedures used was observed, even between classes with identical course titles and offered in the same college. Therefore, this study does not show one best pattern of procedures for teaching in a given situation.
2. When a number of similar courses are studied as a group, a certain pattern of procedures is found to be commonly used.
3. The teachers reporting indicate that they would prefer to use a greater variety of procedures under ideal conditions than they are using under actual conditions. They favor less use of the formal lecture.
4. Procedures which are primarily "teacher-centered" are used twice as extensively as "pupil-centered" procedures. The ratio of "pupil-centered" over "teacher-centered" procedures used in the universities is lower than in the other types of colleges.
5. The teachers report a willingness to use audio-visual aids more frequently if the equipment were available.
6. There is a relatively limited range of use of procedures by university teachers as compared to a more extensive range by teachers in the other three types of colleges.
7. Young teachers use a more limited range of procedures than teachers of the 30-39 age group.
8. Class size is inversely related to the range of procedures used.

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9. In general, teachers with less experience use a more limited range of procedures.

10. Teachers of age 60 and older use a narrow range of procedures and the difference between the actual and ideal use of procedures is small for this age group.

11. The professional education of teachers seems to be positively related to the range of procedures used.

12. Teachers of certain subject areas, such as engineering, use fewer procedures than teachers of other subjects. This tends to lower the use of procedures in the universities reporting, since virtually all of the engineering classes were reported from universities.

#### Recommendations:

1. A program of teacher improvement will probably meet with greater success among the younger teachers under the age of forty. The younger teachers seem to go through a period of expanding the variety of teaching procedures.

2. The providing of funds for instructional equipment is necessary to expand the variety of teaching procedures. The teachers report an actual use of audio-visual aids and other procedures requiring equipment, to be considerably below their desired use for ideal teaching conditions.

3. The reduction of the size of larger classes would give freedom for the teachers to use a greater variety of instructional procedures. This reduction would not, however, guarantee that the teachers would take advantage of this freedom.

#### Suggested Problems for Further Study:

1. A study of instructional procedures actually used by secondary school teachers.

2. Determination of the nature of professional courses in education most profitable to a majority of college teachers.

3. A study of cost and need of equipment for implementing different college instructional methods.

4. The application of instructional procedures in colleges and universities.

**MATHEMATICAL GEOGRAPHY IN AMERICAN  
SCHOOL TEXTBOOKS****(Publication No. 2550)\*****Hugh Smith Rice, Ph. D.  
Columbia University, 1950**

The problem is (1) to determine the extent of mathematical geography in the astronomy, geography, and general science books, of high school and junior high school level, that have been published in the United States, (2) to analyze the nature of the geomathematical subject-matter in these books, and (3) to point out the important differences between the present geomathematical subject-matter and that of the older books.

The general procedure is to examine bibliographies exhaustively, that deal with astronomy books from the earliest printing in the United States to the present, and to examine, where needed, the bibliographies concerning geography and general science books. Lists of likely texts are compiled, and the books are located in libraries or are otherwise obtained. Examination of the texts is made and the proper ones selected for analysis. Analysis is made (of over 200 works), regarding critical points of interest educationally and scientifically. The books are compared with one another in detail, and comparison is made between the different sets. Recent college texts also enter the analysis and comparison as a matter of "control."

Sources of data were libraries including the investigator's library and the Library of Congress, also data obtained from schools and publishers.

The results of numerous points in the analysis of the textbooks is indicated in extensive series of tables showing all data; and typical cases are illustrated by a series of graphs and pie-charts. An important fact derived from the research is that .47 of the space, on the average, in the entire astronomy set, is given to mathematical geography. In individual books the highest ratios extend from .87 downward. In the geography textbooks .08 of the space, on the average, is given to mathematical geography, individual books ranging from .66 to .005 (or in some books zero). The ratio of mathematical geography in the general science set is .06 of the space given to the astronomical and earth-science material; and the highest ratio is .15, and the lowest .01 (or in some books zero).

General science books compared to the astronomy and geography books, devote much more space to the topics of geophysics,

\* Microfilm copy of complete manuscript of 186 pages, \$2.33.  
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Card Number Mic A 51-293.

gravitation, and observational material, and somewhat more to questions; on the topic of tides about the same relative space is given in the general science texts as in the others. Much smaller space is given in the general science books, to topics of celestial sphere, earth, and motions of earth. The attractiveness and appearance of the general science books is much improved over the old books, although some of the printing types and illustrations are inferior to books of older date, and the type of illustrations has been changed. Questions have also altered in type and quality in the recent science books, over those of former years.

The quality of the text-matter of mathematical geography in the general science books is, in general, quite inferior to that in the old astronomies and the college texts. (This does not apply to many individual works.) A distressingly large number of errors is discovered in the science texts, although some books are without errors. Definitions, principles, and illustrations are often faulty. The organization of the geomathematical materials is poor in many of the books, and earth science and geomathematics are sometimes "buried." Errors are classified, discussed, and corrected; justification is discussed; and advice to writers is offered. General science writers would do well to reduce astronomical and mathematical-geography errors, wrong emphasis, bad organization, and poor figures, and have the facts agree better with the material offered by professional astronomers — at the same time preserving the secondary-school level of difficulty.

#### AN EVALUATION OF THE CAMPING PROGRAM OF THE CAMP FIRE GIRLS

(Publication No. 2514)\*

Ruth Mildred Schellberg, Ph. D.  
New York University, 1951

##### The Problem:

The purpose of this research was to evaluate and make recommendations for the improvement of the camping program of the Camp Fire Girls in terms of the characteristics and needs of the girls which this organization serves.

##### Sources of Material:

The evaluation of the camping program of the Camp Fire Girls required data as follows:

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\* Microfilm copy of complete manuscript of 248 pages, \$3.10.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-255.

Characteristics of girls 7-17 years of age.

Needs of girls 7-17 years of age.

Criteria for evaluating a camping program based on characteristics and needs.

The status of the camping program in Camp Fire Girls' camps.

#### Treatment of Material:

Characteristics and needs were recorded in table form according to biological, psychological, and sociological headings. Camping and child development authorities were asked to comment on camping-child development soundness of criteria formulated from the needs.

The analysis of the present camping program of the Camp Fire Girls consisted of a discussion of the availability and popularity of activities in these camps and the methods used to conduct the activities.

#### Conclusions:

1. The girls who constituted the camper group in Camp Fire Girls' camps were similar in background to those who are members of the year-round program in race, creed, and percentage of United States-born parents.
2. The camper group studied represented a cross section in age-range and locality of girls in Camp Fire Girls' camps.
3. Economically they were from the middle class, the camper group representing a higher income group than the girls in the year-round program.
4. Their interests were similar to other girls and they attended these camps for "fun," for "activities," and for "companionship."
5. The camping program was providing nutritious food, attractively served, with individual differences provided for by some camps to a limited extent.
6. There were safe food handlers, by test, in the kitchens of all camps except one.
7. The dining room atmosphere was pleasant except for the many K. P.'s who disliked their chores.
8. Rest was provided according to age group and individual needs in most camps.
9. The intensity of the activity program was regulated by program controls.
10. The findings of a physical examination controlled camper activity and offered protection against contagion.
11. Health was supervised by registered nurses in all camps except one. Physicians were readily available in forty-two of the forty-six camps.
12. The program provided activities strenuous enough to build power and suitable for degree of coordination of each camper.



13. There was opportunity to learn a variety of skills including camp craft.

14. Information concerning sex and growth was available, activities were suitable for girl physique, and opportunity for acceptance and understanding of the girl-role was provided.

15. The camper belonged and participated in the planning of a democratic group. She was aware of the effect of her conduct on the group.

16. Campers formed friendships with other girls of similar background. Friendships with boys were rarely formed as a part of the camping program.

17. Girls observed and formed habits of and attitudes toward work. They learned skills which increased leisure time opportunities and gave them recreational interests they could share with boys.

#### Value of Findings:

Camp directors and camp committees of Camp Fire Girls' camps will find in this evaluation material which will aid in better serving the girls in their camper groups. Interpretation of this program to campers, parents, and staff will be facilitated by it. In addition to those now working with this program there are, each year, new personnel. The results of this study should serve as valuable orientation material for them. Groups other than the Camp Fire Girls are engaged in program planning to provide for needs of children. The camp programming of the Camp Fire Girls should have significance for these groups also.

#### PERFORMANCES CONTRASTED TO MEASURES AS PRECISE ESTIMATORS OF STRENGTH IN PHYSICAL DEVELOPMENT

(Publication No. 2655)\*

Vernon Stephen Sprague, Ph.D.  
University of Michigan, 1951

Physical educators have long been interested in the contribution which strength makes to the developmental life of the individual. This study has selected for intensive investigation the development of strength and the accuracy of the measures used to evaluate its attainment. The literature reveals that two fundamentally different techniques have been used to secure strength data. The push-up and pull-up test items were found to be the most frequently used performance estimators of strength. Similarly, the push-pull dynamometer was found to be the most frequently used measure of strength.

\* Microfilm copy of complete manuscript of 214 pages, \$2.68. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-396.

Many assumptions relative to accuracy, sensitivity, sampling range, consistence, and validity of these two kinds of evidence had not been clarified in the strength-testing field. Definitive test of these assumptions constitute the study of this dissertation.

The data consist of measurements of equivalent muscle groups with pull-up and push-up frequency performances and push-pull dynamometer measurements. The data also include height and weight. These were obtained on 100 boys in each of the following age groups: nine, twelve, fifteen, eighteen, and twenty-one.

The methods of analysis are statistical and graphical. Frequency distributions are recorded graphically and to these graphs the mean and standard deviation, in bar diagram form, are added. Further analysis of the mean and standard deviation include the statistics of standard error, coefficient of variability, and critical ratio. For measurement of association the Pearson Product-Moment coefficient of correlation is presented.

The following conclusions follow from the consideration of the results of the above listed procedures:

1. Results derived from performance estimates of strength do not coincide with those of calibrated measures.

2. Calibrated measures are more efficient and accurate than performance estimates.

3. Precision estimates are complicated more by the differential impact of weight or height in the case of strength performances than in the case of strength measurements.

4. Strength norms established for various age groups by these two measures do not follow the same pattern.

5. Strength development is materially affected by maturity which is indicated by chronological age.

The above conclusions and interest in the field merit the following recommendations for further study:

1. That a longitudinal study be made on the same subjects to further analyze the contributions of total strength to maturity.

2. That a study be made of the strength patterns of children from infancy to nine years of age to supplement this study.

3. That a dynamometric strength investigation be made of other muscle groups to further determine total body strength as an indicator of maturity.

**AN INVESTIGATION INTO THE OPINIONS HELD  
BY ADMINISTRATORS OF BUSINESS EDUCATION  
ON CRUCIAL ISSUES IN THE FIELD**

(Publication No. 2660)\*

**James Rowe Taylor, Ph. D.  
University of Michigan, 1951**

The purposes of this investigation were as follows: to determine the type of individual now charged with the responsibility for the administration of programs of business education in the states and larger cities of the United States; to select from the multitude of statements pertaining to the administration of business education those which appeared to be statements of the most crucial issues in the field; to investigate the position taken by the administrators of business education in regard to those issues; to make a comparison of the opinions held by the administrators of business education with the reactions of a jury of representative secondary school administrators; and to educe certain implications for the administration of business education.

The investigation was prosecuted by means of two instruments prepared specifically for the purpose. The first was a questionnaire designed to obtain certain personal information from the administrator — something of his education preparation and training, his social and professional activities, his professional reading, writing, and speaking. The second was an opinionnaire consisting of forty-three major issues in business education on which the administrators were asked to express an intensity of feeling either for or against the proposition as stated. As a criterion with which to compare the opinions of the business education administrators, reactions to the same propositions were obtained from a representative jury of secondary school administrators.

From the questionnaires returned by 64 state and 112 city administrators of business education, it is possible to conclude that:

1. The median tenure in their present position is 4.7 years.
2. Within the last ten years, 8.9 percent have pursued advanced courses of study.
3. Major administrative attention is given to operating activities, such as finances, equipment, texts, and selection of instructors.
4. Guidance, standards, in-service training, and public relations receive considerably less attention.

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\* Microfilm copy of complete manuscript of 228 pages, \$2.85.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-401.

5. Judging on the basis of speeches and publications, community and professional leadership is limited.
6. The extent and quality of their reading indicates a low level of cultural and professional curiosity.
7. No general pattern is discernible in the path they have followed in arriving at the positions now held.

Findings based on the opinionnaire are as follows:

1. Both groups of administrators agree that the major function of business education involves both general and specialized vocational training.
2. Both groups agree that work experience for business teachers is desirable, and that graduation and certification credit should be granted for it.
3. There is wide-spread support for teacher participation in curriculum adjustments.
4. Administrators of business education reveal a somewhat limited concept of the potential function of business education and of the business education administrator.

Three general conclusions can be drawn from the study. (1) In general, administrators of secondary education and of business education hold substantially similar views on the fundamental questions in the field. (2) Business teacher training programs need revamping, to provide for increased participation in laboratory situations and actual work experience. (3) There is urgent need for a training program for business education administrators, a program designed to guarantee that the position will be filled by those who combine the three attributes of master teacher, successful businessman, and formative business agent.

#### SELF-CONCEPTS AND THEIR SIGNIFICANCE IN THE LEARNING AND ADJUSTMENT OF COLLEGE FRESHMEN

(Publication No. 2662)\*

Ellis Paul Torrance, Ph.D.  
University of Michigan, 1951

This is a study of the ability of entering college freshmen to evaluate their scholastic aptitudes, achievement in English and reading, and vocational interests. It examines changes occurring in these self-evaluations during the course of a five-day orientation program. The social matrices in which these self-concepts evolved

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\* Microfilm copy of complete manuscript of 444 pages, \$5.55. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-403.



and were expressed are also explored in an attempt to understand the psychodynamics of over-, under-, and good evaluation.

At the beginning of the 1949 orientation program, 1215 entering Kansas State College freshmen were asked to estimate how they would stand in relation to their classmates on tests of scholastic ability and achievement. At the end of the orientation program, after they had taken the tests, they were asked to give re-estimates. They were also given an opportunity to "rationalize" their performance by listing any factors which might cause them to perform poorly, and to predict their grades for the freshman year. They were also asked to indicate their vocational interests, after which they filled out the Strong's Vocational Interest Blank.

The relationships were studied of over-, under-, and good self-evaluation to sex, age, religious preference, extreme scores on the Minnesota Personality Adjustment Scale, size of high school graduating class, social prestige of father's occupation. The evaluative characteristics of the following groups (determined on the basis of freshman year performance) were analyzed: withdrawals, scholastic probations, dismissals and reinstatements, leadership trainees, reading clinic enrollees, students advised, students counseled, and students presenting credit in high school "guidance" courses. Case studies using autobiographies and other clinical data were analyzed.

Product-moment coefficients of correlation were used to study relationships between self-evaluations and other variables, and the t-test to study the differences between groups.

Results indicate little relationship between self-estimates of scholastic aptitude or achievement and actual standings on these measures. Achievement is more accurately evaluated than scholastic ability, however. Significant changes in the direction of more accurate evaluation occur during the course of the five-day orientation program. About 50 percent were able to evaluate their vocational interests accurately. Over-evaluation seems to be related to the following factors: sex (male), complaints of headaches and nervousness, low level of education of parents, low social prestige of father's occupation, withdrawal before the end of the first semester, dismissal for academic failure. Good evaluation seems to be related to the following factors: sex (female), good communication, complaints of anxiety about Fraternity Rush Week, Methodist preference, age (17-18), participation in leadership training project.

Very little relationship was found to exist between self-predicted grades and measured ability or achieved grades. Students who later ranked in the lowest 25 percent in scholastic ability expected to make as good grades as those who achieved in the top 25 percent expected to make.

It may be concluded that entering college freshmen hold unrealistic concepts of their scholastic aptitude and achievement. Most college freshmen gradually modify their self-concepts in the direction of reality. Modifications do not come easily as both over- and under-evaluation are defenses for an extremely vulnerable ego.

### THE LIFE AND EDUCATIONAL CONTRIBUTIONS OF JOSEPH D. ELLIFF

(Publication No. 2697)\*

Lester L. Tracy, Jr., Ed. D.  
University of Missouri, 1951

Major Adviser: John Rufi

#### Purpose:

To formulate a connected account of the life and educational contributions of Joseph D. Elliff, Missouri educator (1863- ).

#### Research Technique:

Data obtained from books, periodicals, newspapers, minutebooks, proceedings, journals, official documents, government publications, manuscripts, course outlines, term papers, speeches, letters, interviews with the subject and his contemporaries, and an information blank.

#### Chronology:

Joseph D. Elliff — born in 1863, graduate of Warrensburg Normal School, 1893; A. B., University of Missouri, 1903; A. M., University of Missouri, 1907; attended the University of Chicago and Columbia University. Teacher in the rural schools of Missouri, 1882-92; Principal of elementary school, Carthage, Missouri, 1893; Superintendent of an Indian boarding school, 1893-94; Principal of the Joplin, Missouri High School, 1894-97; Superintendent, 1897-1902; Acting Superintendent of Schools, St. Joseph, Missouri, 1903-04; High School Visitor and Professor at the University of Missouri, 1904-36. Retired in 1936.

#### Conclusions:

This study appraises the life and educational contributions of Joseph D. Elliff while serving as a rural school teacher, public school administrator, and university professor. For almost seventy

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\* Microfilm copy of complete manuscript of 388 pages, \$4.85. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-437.

years he labored for the cause of education in Missouri and for fifty-four years he was an active teacher. Because of his devotion to education he exerted vigorous leadership in many educational endeavors. He served as Director of the University of Missouri summer session for fifteen years, as Chairman of the Missouri State Committee of the North Central Association for a quarter of a century, as an influential member of the Missouri State Teachers Association for over half a century, as Missouri's first State Director of Vocational Education, and as a Curator for Lincoln University and Stephens College for many years.

By some he has been described as having done more than any other person in the development of secondary education in Missouri. Others look upon him as a pioneer leader in the entire educational field.

This study attempts to examine critically the factors and events in his educational life, the decisions he made, and the qualities and attributes which evidently caused him to perform as he did. A life of such a man may reveal clues and even possibly suggest answers to some of the problems a public school administrator, a high school principal, a superintendent of schools, a college professor, or a state and national educational leader may be forced to meet. By showing how one man met these problems, present and future educators may learn better what difficulties early education faced, how our present system of education evolved, and, in the light of past experience, what procedures and techniques may or may not work.

The study necessarily involves some examination of educational, social, and political conditions of the State of Missouri since the Civil War. It presents a description of certain public school systems and an account of the University of Missouri since 1900. It also includes historical accounts of the North Central Association, the Missouri State Teachers Association, Lincoln University, the College of Education, University of Missouri, and Stephens College.

A brief scrutiny of the personal life of the subject is given, including an account of his family, his philosophy, his personal and religious activities, and his use of leisure time. Included in the study is a review of the professional honors that have been bestowed upon this educator and an analysis of opinions of his contemporaries concerning him and his educational contributions.

**A COMPARATIVE STUDY OF THE READING RATE  
CONTROLLER TECHNIQUE VERSUS THE SPEEDED  
READING TECHNIQUE FOR READING IMPROVEMENT  
ON THE COLLEGE LEVEL**

(Publication No. 2515)\*

Shirley Ullman, Ph. D.  
New York University, 1950

The problem upon which the present report is based was concerned with the comparative effectiveness of two different reading training methods upon college freshmen students. The Reading Rate Controller was used as a means of studying the effects of an instrumentation technique for reading improvement. The Speeded Reading Technique was used as a means of studying the effects of a technique for reading improvement devoid of instrumentation.

Three equivalent college freshmen groups were selected who were as close to the means as possible in order to select 150 students from a college population of 1800 on the basis of their scores on the American Council on Education, Psychological Examination for College Freshmen, and the American Council on Education, Cooperative English Test, C-2, Reading Comprehension, Higher Level; the former is an intelligence test and the latter is a reading test. One experimental group used the Reading Rate Controller Instrument; the other experimental group used Speeded Reading. The third group was a Control Group.

To ascertain gains accrued during the five week training period pre-test and post-test scores were obtained and compared for the 150 subjects on (1) the Iowa Silent Reading Test, (2) the Rate sub-test of the Iowa Silent Reading Test, (3) the Comprehensive sub-test of the Iowa Silent Reading Test, (4) the Cooperative English Test, C-2, Reading Comprehension, Higher Level, (5) Words per Minute on the Reading Rate Controller, and (6) Comprehension on the Reading Rate Controller.

The Reading Rate Controller Technique (an instrumentation technique) did produce genuine gains in reading rate and comprehension (and general reading ability). This was demonstrated by the significant results made on the entire test battery. The Speeded Reading Technique (instruction devoid of instrumentation) did produce genuine gains in reading rate and comprehension (and general reading ability). This was demonstrated by the significant results made on the entire test battery.

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\* Microfilm copy of complete manuscript of 136 pages, \$1.70.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
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A comparison of the Reading Rate Controller Technique Group with the Speeded Reading Technique Group indicated superiority of the Reading Rate Controller Technique in rate, only. All other reading skills and abilities were the same for the two experimental groups. Comparison of the Reading Rate Controller Technique Group with the Control Group indicated the superiority of the Reading Rate Controller Technique over the Control Technique. Comparison of the Speeded Reading Technique Group with the Control Group indicated the superiority of the Speeded Reading Technique over the Control Technique. Greater gains in reading rate and comprehension (and overall reading ability) were observed as a result of training in reading.

Where real differences in variability existed, the trend was for an increase in heterogeneity. This indicates that training in reading tends to produce greater variability in reading.

#### **A STUDY OF PATTERNS OF PERFORMANCE FOR THE MOST FREQUENT DUTIES OF BEGINNING CLERICAL EMPLOYEES**

(Publication No. 2516)\*

Elizabeth A. Tilton Van Derveer, Ed. D.  
New York University, 1950

This study developed patterns of performance for the sixty-nine most frequent operations of clerical workers. Patterns of performance are a synchronization of the way clerical activities, as they emerge from the analysis of individual operations, are done on the job. As operators are observed, a synthesized sequence of steps presents itself. While individual operators may deviate in minute details — usually evidences of inefficient operation — the sequence of steps of the skilled worker is surprisingly uniform.

These patterns of performance were developed from actual job observation of seven hundred thirteen clerical workers in seventeen different business organizations. The operations selected for study were determined by an analysis of nine outstanding surveys of clerical work. Sixty-nine most frequent operations of the office clerk resulted from this study and constitute the essential basis for training clerical workers.

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\* Microfilm copy of complete manuscript of 328 pages, \$4.10. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-257.

The operations are classified as follows:

**Filing and Sorting Duties:**

- Typing file labels
- Preparing work space and tearing labels
- Coding
- Preparation for sorting with Multi-Sort
- Fine sorting with Multi-Sort
- Bin sorting
- Table or desk sorting
- Filing in folders
- Finding filed materials

**Duplicating Duties**

(Mimeograph):

- Preparing dummy copy
- Preparing the typewriter
- Cutting the stencil
- Correcting the stencil
- Proofreading
- Removing protective cover
- Placing stencil on the machine
- Setting the paper feed
- Hand feeding, adjusting copy
- Running copy (hand and electric)
- Preparing blotting sheets
- Slipsheeting
- Removing stencil
- Filing stencil
- Separating slipsheets
- Storing copies
- Cleaning up machine and work area

**Non-Specialized Duties:**

- Using the paper cutter
- Fanning papers
- Using the stapler
- Collating

**Duplicating Duties (Fluid):**

- Typing master sheet
- Correcting errors

**Typewriting Duties:**

- Preparing carbon packs
- Inserting carbon packs
- Erasing original copy
- Erasing carbon copies
- Addressing envelopes
- Addressing labels
- Filling in forms
- Using padded forms
- Filling in form letters
- Aligning typed copy
- Proofreading

**Mailing Duties:**

- Addressing envelopes
- Addressing labels
- Tearing labels
- Mailing circulars
- Folding circulars -
  - large envelope
  - small envelope
- Opening envelope flaps
- Stuffing envelopes -
  - first-class mailing
  - second-class mailing
- Sealing envelopes
- Stamping envelopes

**Telephoning Duties:**

- Using the telephone directory
- Station-to-station call
- Person-to-person call
- Answering the telephone

**Adding Machine Duties:**

- Adding
- Checking for proof

A presentation of how to teach others to use these patterns of performance is an essential part of the document, as are a series of illustrations of types of learning materials with which the patterns can be used.

These patterns of performance can be used, and, to some extent, have been used, for teaching the basic skills of clerical training in a real or simulated situation. They give an essential basis hitherto unavailable for job evaluation, job descriptions, and for the development of job salary schedules.

The learner will benefit in at least two ways in the use of these materials: first, because he will be taught in an organized fashion; and, second, because he will have learned to use the job-analysis technique in approaching a problem.

Previous job analyses and surveys have failed to define the differences between the all-over nature of the position, the duty, the job, the operation, and the step in clerical processes. This analysis makes scientifically clear distinctions which have never heretofore been available. Job analysts, office managers, job evaluators, and business teacher trainers, as well as secondary school teachers of clerical activities, will find the patterns of performance established in this study an essential basis for the development of their work.

#### ACCOUNTING FOR ACTIVITY MONEY IN MISSOURI PUBLIC SECONDARY SCHOOLS

(Publication No. 2698)\*

Bernard Herman Voges, Ed. D.  
University of Missouri, 1951

This study of accounting for activity money in Missouri public secondary schools was planned for the immediate purpose of identifying and clarifying some of the important problems. Specific considerations are analyzed in four categories:

1. What are the sources of school activity money and for what purposes is such money used?
2. What are the current practices in the accounting for activity money in Missouri public secondary schools?
3. Are there valid educational practices which provide for democratic pupil participation in accounting for activity money?
4. What procedures may be used in accounting for activity money in Missouri public secondary schools which are educationally sound and are valid from the standpoint of principles of accounting?

A survey was distributed among 640 high schools in Missouri, to collect data in order to discern the considerations above. Five hundred and five survey blanks, representing 78.91 percent were returned.

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\* Microfilm copy of complete manuscript of 225 pages, \$2.81.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-438.

Replies were tabulated by use of International Business Machine (IBM) equipment. A survey was conducted among all the states of the nation, excluding Missouri. Data were furnished through cooperation of chief state school officers. The survey among states was made to determine if states were concerned with the problem and their degree of concern.

The report is presented under six major divisions, namely: introduction to the problem, showing need for the study as evidenced by malpractices, lack of direction, absence of laws, regulations or official suggestion, or other interest in Missouri; presentation of legal implications in Missouri, including an examination of several audit reports concerned with activity money; analysis of practices in other states; examination of practices involved in accounting for activity money in Missouri; suggestions for a plan of activity accounting for use by schools; and summary, conclusions, and recommendations based on reported data.

Some of the pertinent observations are:

1. Important sources of activity money are derived from fees or dues for membership in activities, admissions to activities, revenue from sales of products, and in a few instances loans or grants by boards of education.
2. Athletics constitute the most frequent reason for expenditure of activity money and home rooms or prizes represent the most infrequent use for activity expenditures.
3. Superintendents of schools are most frequently responsible for accounting for activity money.
4. In over three-fourths of the schools one individual is responsible for the receipt and expenditure of activity money.
5. Substantial amounts of money are involved in activity accounting records as follows:
  - (a) The 1949-50 expenditures for activities in 394 schools amounted to \$3,122,319.79.
  - (b) For the same year per pupil expenditure for activities amounted to \$20.87.
  - (c) The average expenditure per activity amounted to \$848.69.
6. Audits of activity money accounting records are made. Many of the reported audits do not seem to be the type of audits conducted by certified public accountants.
7. Reports of activity money records are made to boards of education.
8. Evidence does not indicate use of budgetary procedures in planning and accounting for activity money.
9. Respondents agree that there is need for a uniform, but flexible activity accounting procedure.
10. Almost one-half of the reports from states indicate a degree of concern for the problem.



11. Six states report that their concern is evidenced by statutory proviso.

12. More states report that the degree of concern is or should be through a suggestive process.

Chapter V of the study represents a presentation of a plan for use by schools in accounting for activity money. The plan suggested is based on the premise that boards of education through leadership of their chief executive officer will desire to:

1. Clearly define activity money.
2. Specify measures for efficiency.
3. Adopt a plan for accounting and reporting.
4. Define responsibility and duties of agents.
5. Clearly prescribe responsibility of the board of education.

#### AN ANALYSIS OF THE PHYSICAL AND PHYSIOLOGICAL CHARACTERISTICS AND ENDURANCE PERFORMANCE OF YOUNG WOMEN

(Publication No. 2518)\*

Rachael Dunaven Yocom, Ph.D.  
New York University, 1951

The purpose of this investigation is to conduct an analysis of three groups of normal young women (eight in each group) between the ages of nineteen and twenty-three in respect to the relationships existing among physical and physiological characteristics and endurance performance. The significance of this study lies in its contribution toward clarifying the relationships mentioned above, and to the further study of the physiology of exercise.

The experimental procedure began with volunteer subjects reporting singly to the research laboratory, dressed in the proper uniform. Insertion of an arterial needle into the right antebrachial artery under procaine injection, insertion of a rectal thermocouple, the attachment of a cardiometer, and connection of the subject to an air collection apparatus made possible measurements for the determination of a basal state.

A treadmill run (to complete exhaustion) at an 8.6 percent incline and for successive speeds of 2.3, 3.5, 4.6, and 6.9 miles per hour, constituted the endurance criterion. Air samples, respiration rate, heart rate, temperature, and arterial blood samples were measured at six minute intervals. At the conclusion of the run, the

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\* Microfilm copy of complete manuscript of 287 pages, \$3.59. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-261.

subject was placed in a supine position and measurements were taken during a 120 minute recovery period.

The variables measured were: blood hematocrit, plasma volume, oxygen, lactic acid, and pH; oxygen consumption and carbon dioxide output; ventilation volume; respiration rate; body temperature, vital capacity, oxygen debt, and selected physical measurements. The subjects were ranked according to Calories per square meter of body surface expended during the treadmill run. Comparisons were made between the first eight (high endurance), the second eight (moderate endurance), and the third eight (low endurance). The data were presented graphically and the significance of the differences between the means of the three groups of endurance and coefficients of correlation were determined.

On the basis of the data presented in this study, the following conclusions were reached:

Endurance performance differs significantly, although there is no significant statistical (1.0 percent level of confidence) difference in pattern, direction, and magnitude of physiological change.

Total Oxygen consumption is directly related to the total amount of work done.

During exercise:

Hematocrit and arterial blood oxygen increase.

Plasma volume decreases.

Increases occur in respiration rate, respiration depth, oxygen consumption rate, carbon dioxide output, respiratory quotient, and ventilation volume.

Rates of oxygen consumption and carbon dioxide output are highly correlated. They are also highly correlated with ventilation volume.

Ventilatory efficiency decreases.

Lactic acid concentration increases immediately with the onset of exercise.

Those individuals doing less work increase blood lactate more rapidly so that at the completion of exercise, the final lactate levels, as indicated by the means of the three groups are almost the same.

Maximum blood lactate is unrelated to total amount of work done.

Lactic acid concentration is not directly related to total oxygen consumption or oxygen debt.

Blood lactate changes are related to pH changes, ventilation volume, and rates of oxygen consumption and carbon dioxide output.

Maximum blood lactate change at completion of exercise is unrelated to oxygen debt.

Oxygen debt is unrelated to degree of endurance.

**Recovery:**

With the exception of lactic acid (and a respiratory quotient rise during the first 15 minutes of recovery), there is a sharp decrease in all of the physiological variables in the first 45 minutes, and a return to basal (pre-exercise) levels within the two hour recovery period.

**Physical Measurements:**

Physical measurements of the subjects studied are only slightly related to total work done.

Weight, sitting height, shoulder width, and thigh girth show significant differences between the means of groups one and three.

## EDUCATION AND PSYCHOLOGY

### THE SIGNIFICANCE OF DISCREPANCIES BETWEEN QUANTITATIVE AND LINGUISTIC ABILITIES FOR SCHOLASTIC SUCCESS AND COLLEGE ADJUSTMENT

(Publication No. 2696)\*

Thurman Edwin Smotherman, Ed. D.  
University of Missouri, 1951

Major Adviser: Paul C. Polmantier

**Purpose:**

To describe the scholastic success and college adjustment of students who show significant discrepancies between quantitative and linguistic abilities on the basis of their performances on the Quantitative and Linguistic Sections of the American Council on Education Psychological Examination for College Freshmen, 1942 Edition.

**Methods of Procedure:**

An analysis was made of three groups each of male and female students. Grouping was made on the basis of significant discrepancies between quantitative and linguistic abilities as measured by the A. C. E.; analysis of educational background data; analysis of college scholastic achievement; and analysis of out-of-the-classroom activities.

\* Microfilm copy of complete manuscript of 188 pages, \$2.35. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-436.

**Summary:**

(1) The groups in the study were more alike than different in general background. The differences found in this area were neither indicative of success nor lack of success in pursuing college work.

(2) Students showing differential ability in performance on the linguistic and quantitative scales of the A. C. E. show definite differential preferences in choice and attendance of schools and colleges. Among the male students those classified as linguistic favorites showed significant preference toward the School of Journalism, whereas, the quantitative favorites showed statistically significant preference for the College of Engineering and for the School of Business and Public Administration.

(3) The scholastic achievement of the linguistic favorites was superior to the scholastic achievement of the quantitative favorites and to those students favoring neither the linguistic nor quantitative areas on the A. C. E. This condition held true for both sexes.

(4) When total scores on the A. C. E. are equal, those students who show a significantly greater amount of linguistic ability than quantitative ability have more scholastic success than students who show a significantly greater amount of quantitative ability than linguistic ability.

(5) Among the male groups the quantitative favorites had the highest drop-out rate for the first two years of college work. However, over the last two years of college work the percent of drop-outs was about the same in each of the groups studied.

(6) Among the female groups there was little variance among the groups in the number dropping out of college and in the percentage of the groups gaining degrees.

(7) Male students who show significantly more linguistic ability than quantitative ability were found to be more active in national social fraternities and in student publications than was either of the other male groups studied. There was a trend in this direction by the female groups in the study.

(8) Neither male nor female groups showed significantly greater use of the University Student Personnel Services, however, the data approached statistical significance and would indicate a need for research in this area.

(9) The indications are that the A. C. E. is more effective for men than for women as a determinant of scholastic success and extra-curricular participation in college. Hence, the Quantitative, the Linguistic, and the Total scores would seem to have more importance in the counseling of male students than they have for female college students.



**Recommendations:**

(1) That a type of score which will show discrepancy between quantitative and linguistic abilities on the A. C. E. be used in counseling college students.

(2) That insofar as is possible, counseling be provided in the first year of college particularly for those male students who perform significantly higher on the quantitative scale than on the linguistic scale of the A. C. E.

**ENGINEERING, AERONAUTICAL****ON THE REFLECTION OF SHOCK WAVES  
IN THREE DIMENSIONS**

(Publication No. 2623)\*

Eugene Migotsky, Ph.D.  
University of Michigan, 1951

This paper presents the results of a theoretical and experimental investigation of the reflection of steady shock waves in three dimensions.

The non-viscous theory of shock wave reflections is extended to the three-dimensional case by applying the sweepback principle locally along the curve of intersection of shock surface and body. Two special cases, namely a plane shock reflecting from a plane wall, are studied in detail. In both cases it is shown that an irregular reflection must exist over part of the body even if regular reflection exists at the point where the shock first reaches the body. In addition, the existence of expansion waves, which weaken the shock, on the lee side of the circular cylinder are indicated.

The emphasis of the experimental investigation was placed on the study of the effects of geometry for the case of a plane shock reflecting from a circular cylinder at a Mach number of 1.90. The effects of boundary layer character and thickness were also studied for this configuration. Shock waves of moderate strength, corresponding to flow deflection angles of  $8.0^\circ$ ,  $10.3^\circ$ , and  $11.5^\circ$  near the body, were used for this investigation.

Surface pressure distributions on the cylindrical body are presented for several meridian angles. Some total head pressure measurements supplement the data. Normal and yawed schlieren and shadow

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photographs showing typical shock-reflection patterns and boundary layer behavior in meridian planes corresponding to meridian angles of  $0^\circ$  and  $25^\circ$  are also presented. The results obtained in this investigation are compared with the non-viscous theory and with previous two-dimensional shock-wave boundary-layer interaction studies. An application to the calibration of supersonic wind tunnels is also indicated.

From this study it is clear that to the previously recognized parameters governing shock reflection phenomena, such as boundary layer character and thickness, shock strength, etc., should be added the geometry of the configuration. The results show that existing theory does not satisfactorily explain the complex phenomena of shock-wave boundary-layer interaction and that additional work is necessary. The present investigation should give additional insight into this complicated problem.

## ENGINEERING, CHEMICAL

### PREDICTION OF HYDROCARBON VAPOR-LIQUID EQUILIBRIA

(Publication No. 2632)\*

Elliott Irving Organick, Ph. D.  
University of Michigan, 1950

A correlation for predicting equilibrium volatility constants, or ratios,  $K = y/x$ , for hydrocarbon systems is developed based on experimental data for binary systems of normal paraffins containing methane, and a variable described as the correlating pressure. By employing an empirical relationship, based on critical pressures for methane binary systems, the correlating pressure for any mixture of paraffin hydrocarbons, binary or complex, is defined in terms of three other variables: the equilibrium pressure, and functions of the equilibrium vapor and liquid phase compositions. These functions are the molal average boiling point of the vapor and the weight average equivalent molecular weight of the liquid. The equivalent molecular weight of a component is a function of its boiling point for paraffinic and olefinic compounds, and is a function also of the characterization factor for naphthenics, aromatics, and other non-paraffins of high molecular weight. The equivalent molecular weight is also used to compute the "equivalent mol fractions",  $y$  and  $x$ , in the relationship  $K = y/x$ .

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All published binary and complex experimental vapor-liquid equilibrium data for hydrocarbons have been used to test and extent this correlation. These data agree with values indicated by the correlation in all ranges of temperature and pressure within the experimental uncertainty.

## ENGINEERING, CIVIL

### TORSION IN LOCK GATES AND PRESTRESSING OF DIAGONALS

(Publication No. 2649)\*

Carl Louis Shermer, Ph.D.  
University of Michigan, 1951

A miter-type or arch-type lock-gate leaf tends to twist or warp when it is being swung through the water or even when it is just hanging stationary in the open position. The action of the diagonal braces in resisting this twisting or torsion has not been understood in the past and the assumptions used in designing diagonals have been false.

In this dissertation, lock-gate leaves are analyzed as problems in torsion. The real function and behavior of diagonals in resisting this torsion is described. The advantages of prestressed diagonals are discussed, and design methods and field techniques for prestressing are presented.

Two design examples are worked out using actual gates. One is of a gate designed originally for prestressing. The other is of a gate not designed for prestressing but which is subsequently prestressed, without structural alteration, to obtain the advantages mentioned.

Results of tests made on actual gates and on numerous models are presented. Test results confirm the torsion theory and illustrate the advantages of prestressing.

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THEORETICAL INVESTIGATION OF A RECTANGULAR  
RESONANT RING IN A RECTANGULAR WAVE GUIDE  
TRANSMITTING A  $TE_{10}$  WAVE

(Publication No. 2579)\*

Shou-Hsien Chow, Ph. D.  
University of Michigan, 1951

This dissertation presents a theoretical method for treating a metallic rectangular resonant ring transversely located in a rectangular wave guide which transmits only the dominant  $TE_{10}$  mode. It is assumed that the guide wall and the ring have infinite conductivity. The ring has a finite thickness in the longitudinal direction. At resonance, the ring serves as a complete reflector.

In the first part of the study, a general description of metallic obstacles in wave guides, a brief review of electromagnetic theories relating to the problem of obstacles in wave guides and the theoretical methods of treating simpler types of obstacle problems are given.

In treating the metallic rectangular resonant ring, the current induced in the ring by an incident  $TE_{10}$  wave is assumed to have a certain distribution. The electromagnetic field in the guide is derived from the current distribution by means of a Fourier integral transform. The satisfaction of boundary conditions at certain points on the ring surface determines the complete field, and therefore the equivalent shunt susceptance which represents the effect of the ring.

The effects of the ring size, the aspect ratio of the ring, and the frequency of the incident wave are treated separately. Numerical examples are given.

The accuracy of the assumed current distribution on the ring is checked by a numerical example showing how closely the boundary condition is satisfied over the whole ring. The effect of any deviation of the assumed current distribution from the true one on the results of this theoretical investigation is estimated.

The results of this investigation agree with experimentally determined results by other investigators. The size but not the aspect ratio of the ring is the dominating factor in determining the resonant property of the ring. A resonant ring remains substantially a complete reflector within a limited frequency range of the incident wave.

This method can also be applied to the problem of a resonant post in a rectangular wave guide.

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## A HIGH-RESOLUTION SYSTEM OF AUTORADIOGRAPHY

(Publication No. 2595)\*

Henry Jacob Gomberg, Ph. D.  
University of Michigan, 1951

Autoradiography has been used extensively for the general location of radioactive inclusions within materials and tissues, but it has not been possible until now to use this technique for high resolution studies. A new autoradiographic process, capable of one micron resolution and suitable for use with beta particle emitters has been developed. This process is suitable for radioactive tracer studies in single cells of biological specimens, grain structures in metals, and similar problems where high resolution is necessary.

To detect beta particles from radioactive tracers, a one micron layer of sensitized crystals is grown directly on the surface to be studied. The point at which the beta particles leave the surface and enter the sensitized layer may be located within one micron by the effect of the beta particle on entering the layer. Where direct chemical interactions between the surface and the sensitized layer occur, a thin inert protective film must be used. The process is not complicated and may be carried out with equipment available in college chemistry and hospital laboratories.

In the course of the development of this process, it was found that the existing theories are inadequate to explain some of the effects observed in beta particle or x-ray interaction with film. A new mechanism, displacement of lattice ions in Rutherford scattering of high speed electrons, is proposed for further investigation as the cause of the observed effects.

## LOGICAL SYNTHESIS OF COMPUTER CIRCUITS

(Publication No. 2497)\*\*

Richard B. Marsten, Ph. D.  
University of Pennsylvania, 1951

The object of this work is to develop an analytical tool which will, in application, facilitate direct design of component parts of

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computing devices. The tool is required to be useful in a nonambiguous analysis of the operation of a given system, so that unfamiliar systems whose physical configurations are known will be easily subjected to direct study. Thus it is expected to obviate the currently prevailing methods of trial-and-error in computer design and analysis.

Mathematical logic is chosen as the medium of expression for this study, and satisfactory results are obtained with it. The system of mathematical logic prove directly applicable to certain types of crystal and vacuum-tube circuits which form the basic components of electronic computers. An unambiguous correspondence between circuit components and logical perimitives is established, together with conventions for interpreting logical expressions as indicative of physical phenomena. A method of analysis is found which describes the operation of the given system in terms of its operation on the input information and which is independent of the physical layout of the system; the method consequently is applicable in determining whether or not two physically different systems are functionally alike. Finally, by using a synthetic approach to the design problem, a general method of synthesis is developed from the mathematical logic used here. The method is applied to the synthesis of binary half-adders, binary adders, binary adder-subtractors, shifting registers, memory circuits, timers, comparing circuits, and coded-decimal adders. Limitations on the method are found as expected, and conditions for physical realizability are determined. The procedure is examined for the possibility of yielding minimum-component systems with some degree of success, but does not seem to be generally reducible in terms of minimization theorems. The conclusions drawn from the results obtained are that the synthesis procedure is applicable to a wide variety of circuits, and is not restricted only to electronic-type circuits but applies to any system whose component parts can be described in terms of logical primitives.

**A STUDY OF THE INFLUENCE OF A STRONG TRANSVERSE  
MAGNETIC FIELD ON AN UNCONFINED GLOW DISCHARGE  
IN AIR AT ABOUT 1 mm PRESSURE**

(Publication No. 2619)\*

Warren Dale McBee, Ph. D.  
University of Michigan, 1951

This study is both experimental and theoretical. The experimental objective is the investigation of the principal characteristics of the discharge over wide ranges of the independent variables involved. The theoretical objectives are (1) the derivation of electron and ion mobilities as functions of those independent variables, and (2) the formulation, from these mobility relations, of concepts as to the mechanisms of current conduction and discharge perpetuation.

The discharge investigated is an unconfined direct-current glow discharge in air between two parallel cylindrical electrodes, which are one-half inch in diameter and spaced about 1 1/2 inches apart. The magnetic field is applied uniformly in a direction parallel to the axes of the electrodes, i.e., perpendicular to the planes of current flow. The independent variables and their ranges of variation are as follows: (1) pressure, 0.2 to 10 mm of Hg.; (2) magnetic flux density, 50 to 7000 gauss; (3) discharge current, 0.1 to 2.5 amperes. The discharge characteristics observed are as follows: (1) appearance; (2) net momentum, or wind; (3) probe volt-ampere characteristics; (4) time-average potential, including total drop, separation of anode, cathode, and plasma drops; (5) mapping of the potential field; and (6) analysis of potential fluctuations, using single-sweep oscillograph techniques.

The theoretical study is based on the fundamental Lorentz force equation. From this the free-path trajectories of ions and electrons are derived. These trajectories are then averaged on the basis of the statistics of particle encounters to give the net drift velocity, and hence mobility, of both ions and electrons. It is shown that, in addition to altering the mobility in the direction of the electric field, the magnetic field gives rise to a mobility component which is orthogonal to both electric and magnetic fields. For this reason, the use of complex number notation is introduced and the mobility is expressed as a complex quantity.

The experimental variations of discharge characteristics with pressure, current, and magnetic field strength are then correlated with the variations of the derived complex ion and electron mobilities.

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The degree of correlation which can be drawn indicates that the steady-state theories used are substantially applicable to this situation, although certain details of the observed behavior require consideration of the instabilities and fluctuations which are present.

## ENGINEERING, MECHANICAL

### A QUANTITATIVE ANALYSIS OF THE EFFECTS OF SIDEWINDS AND GUSTS ON THE STABILITY OF AN AUTOMOBILE OPERATING AT MEDIUM AND HIGH SPEEDS AS DETERMINED FROM ROAD TESTS

(Publication No. 2617)\*

Philip Wood Lett, Jr., Ph. D.  
University of Michigan, 1951

The purpose of this investigation was to determine from road tests the effects of sidewinds and gusts on the stability of an automobile traveling at speeds of 40 to 80 mph. Resultant wind (the vector sum of the wind due to the car's motion and the natural wind) was measured. Reaction to resultant winds was analyzed by measuring sidewise force and the tendency to yaw.

The procedure followed in this investigation was to instrument and test a production car, 1947 model. All connections between body and chassis were removed and the body supported by four steel columns attached rigidly to the frame. Forces transmitted from body to frame through these columns were measured by electric resistance strain gages. A bridled anemometer and wind vane were utilized to measure wind speed and direction. Lateral force at each support column, resultant wind speed, resultant wind direction, and car speed were recorded photographically. Tests were run on level pavement with a variety of wind conditions and car speeds.

Results of the tests showed that the sidewise force and yawing moment grew larger at an increasing rate as resultant wind speed became greater (angle of attack of the resultant wind constant). The location of the center of pressure did not vary as long as the angle of attack was unchanged. Center of pressure here refers to the point of application along the longitudinal axis of the car of a single force equivalent to the total resultant wind resistance.

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Small changes in angle of attack of resultant winds from a frontal direction affected significantly the magnitude of the sidewise force registered by the car. As angle of attack changed from  $0^{\circ}$  to  $5^{\circ}$  resistance due to body shape with consequent air turbulence caused sidewise force to increase at a much greater rate than a direct proportion with enlarging normal area.

The center of pressure of the resultant wind force was shown to move closer to the center of gravity of the car as the angle of attack of the resultant wind increased. For the particular car tested the center of pressure moved from approximately 30 in. forward of the center of gravity with an angle of attack of  $5^{\circ}$  to a position 14 in. forward of the center of gravity with an angle of attack of  $35^{\circ}$ .

The sudden application of sidewise force by a gust moved the car laterally and produced a tendency to yaw away from the applied force. Corrective steering action by the driver was required to return the vehicle to the original direction of travel. Lateral acceleration of the mass of the car by this corrective action was responsible for the largest sidewise forces in an interval where a gust acted — a maximum value of 240 lbs. was recorded.

#### Conclusions:

A diminution of the sidewise force due to cross-winds could be accomplished only by the reduction of the air resistance of the vehicle to all resultant winds whose direction falls within the first quadrant. The tendency to yaw could be decreased by (a) reducing the sidewise force due to winds, and (b) reducing the distance between the center of pressure and the center of gravity. Additional cross sectional area rearward of the center of gravity and normal to cross-winds would reduce the tendency to yaw by reducing the distance between the center of pressure and center of gravity.

## ENGINEERING MECHANICS

### LARGE DEFORMATION OF ELASTO-PLASTIC CIRCULAR PLATES WITH POLAR SYMMETRICAL LOADING

(Publication No. 2628)\*

Paul Mansour Naghdi, Ph. D.  
University of Michigan, 1951

A general theory for the elasto-plastic bending of thin circular plates with polar symmetrical loading is developed, and a numerical

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integration method is given for the complete solution of problems within the scope of the general theory. In the development of the theory, stress-strain relations of the deformation type (theory of plastic deformation) are employed, and, in addition, the following assumptions are made:

1. The material is homogeneous.
2. The material is isotropic.
3. Both the bending strains and the membrane strains are small in comparison with unity.

As special examples of the general theory, simply supported circular plates with a central concentrated loading are considered. Using a stress-strain curve for 24-ST aluminum which is determined experimentally, numerical solutions (i.e., bending moments, membrane forces, and deflections) are obtained for two cases. In one case, the plate experiences large elastic deformation, and in the second case, the plate undergoes large elasto-plastic deformation.

To verify the validity of the general theory, several plate specimens are made of the same sheet of 24-ST aluminum for which the above-mentioned stress-strain curve is determined. The deflections of these plate specimens for various loads are determined experimentally and the results are compared with the deflections obtained analytically. The agreement between the experimental and the theoretical results is very good, the maximum deviation being approximately 5 percent near the concentrated load.

It is concluded that the general theory should have several practical applications, one of which is its value in die design for the stamping and drawing of thin metal sheets.

## INELASTIC BUCKLING OF COLUMNS OF VARYING SECTION

(Publication No. 2630)\*

Robert Eugene Newton, Ph. D.  
University of Michigan, 1951

This study is devoted to the buckling loads of initially straight, centrally loaded, hinged end columns of compact, varying section. Attention is primarily directed to columns short enough that the average compressive stress at some or all cross-sections exceeds the proportional limit of the material before buckling occurs. Both theoretic and experimental investigations are included.

The theoretic portion covers the derivation of Euler's differential equation for buckling of elastic columns, its extension to inelastic

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behavior by introduction of the tangent modulus of elasticity, and its further generalization to include columns of varying section. Various numeric methods of solution are discussed. In an appendix, the tangent modulus theory is applied to the problem of finding the column of minimum weight necessary to transmit a given load over a specified distance.

Experimental studies were made upon columns of three different materials: hot-rolled mild steel, aluminum alloy (ALCOA 24S-T4), and magnesium alloy (Dow J-1). For each material two series of columns of varying section were tested. In one series the rectangular sections were of constant depth and the width varied linearly from a maximum at the center section to a value half as great at the end sections. In the other series, the width was constant and the depth varied linearly from a maximum at the center to a value eight-tenths as great at the ends. In addition to these columns of varying section, compression stress-strain specimens and a series of columns of constant section were tested for each material.

The investigations undertaken appear to warrant the following conclusions for centrally loaded straight columns of continuously varying compact section:

1. The differential equation initially derived by Euler satisfactorily predicts the load at which bending will begin if the tangent modulus of elasticity is substituted for the initial modulus in this equation;
2. For all except the very short columns the ultimate load does not appreciably exceed the load at which bending begins;
3. The ultimate load of short columns made from a material with a pronounced yield stress may appreciably exceed the tangent modulus load because of the phenomenon of work-hardening;
4. The material economy to be achieved from the use of varying sections declines rapidly with decreasing slenderness ratio in the inelastic range.

## ENGINEERING, METALLURGICAL

### FUNDAMENTAL RELATIONSHIPS BETWEEN PRIOR PROCESSING AND HIGH TEMPERATURE PROPERTIES OF TWO CREEP RESISTANT AUSTENITIC ALLOYS

(Publication No. 2594)\*

Donald Nelson Frey, Ph. D.  
University of Michigan, 1951

This investigation was concerned with the fundamental reasons for the variation with prior processing of high temperature properties of two creep resistant austenitic steels. Previous investigations had shown that such variation was extremely large and completely masked, in many cases, changes in chemical composition in austenitic steels employed for their high temperature strengths.

Creep resistant austenitic steels have become more or less standardized into two groups: those requiring precipitation hardening to develop optimum properties and those given either a solution treatment and short-time-aging (which results in only small increase in hardness) or cold working to develop optimum properties. Accordingly, one alloy was selected for study from each group, Inconel-X from the former and Low-Carbon N155 from the latter. Further, Low-Carbon N155 was studied in both the solution treated and aged condition and cold worked condition while Inconel-X was studied only in solution and aged condition.

By using a combination of creep and rupture testing, x-ray diffraction studies, and microstructural examinations, relationships between internal crystalline structure, due to various types of prior processing, and creep and rupture properties were established. It was found that aging in general reduced the creep resistance of solution treated Low-Carbon N155 through removal from random solid solution of the effectively large sized atoms, these atoms forming the precipitates. While these precipitates introduced internal stresses in the matrix of Low-Carbon N155, the periodicity of these stresses was too large to hinder the flow processes resulting in creep. It was also found that the rupture resistance of solution treated Low-Carbon N155 was increased by aging, such aging forming an additional phase in the grain boundaries which changed the type of fracture from brittle intergranular to ductile transgranular. Presumably, crack propagation through the grain boundaries without the additional phase required less stress than when the additional phase was present.

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Aging on the other hand markedly improved the creep resistance of Inconel-X since the precipitates and coexisting stress fields had a small enough periodicity to effectively hinder the flow processes. Short time rupture resistance was also improved by aging, apparently by the presence of closely spaced stress fields surrounding the precipitate particles. Long time rupture strengths appeared to be independent of the magnitude of internal stresses due to precipitation and in fact such strengths were approximately the same for all the aged conditions.

Cold working was found to improve the creep resistance of Low-Carbon N155 by introducing stress fields resulting from the inhomogeneous character of the plastic deformation. It was found that "cold" working to improve creep resistance could be carried out at temperatures up to those at which internal relaxation of the deformation stresses occurs during the rolling operation. This useful range of working temperatures was found to encompass the so-called "warm working" range now widely used commercially. Further cold working can be expected to improve creep resistance up to those service or test temperatures at which internal stress relaxation occurs to an appreciable extent, during the service or test life. Lastly, it was found that the useful amount of cold working was limited by that reduction which suppressed the temperature for appreciable internal stress relaxation to the service or test temperature.

## ENGINEERING, MINING

### THE RELATIONSHIP OF REGIONAL STRUCTURAL GEOLOGY TO THE ORE DEPOSITS IN THE SOUTHEASTERN MISSOURI MINING DISTRICT

(Publication No. 2684)\*

Jack Alexander James, Ph. D.  
University of Missouri, 1951

The relationship of the regional structural geology to the ore deposits is the principal subject, although the regional characteristics of the most favorable host rock (Bonneterre formation) and the contiguous Upper Cambrian formations (Lamotte below and Elvins group above) are discussed. The sedimentary succession was deposited upon the rugged erosional surface of the pre-Cambrian basement igneous rock. The feldspathic residuum was reworked into

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deposits of conglomerate, arkose, and silty shale, and was incorporated also in the first sediments deposited at any particular locality. Thus conglomerate and arkose directly related to the Bonneterre indicate an area of non-deposition of the underlying basal Lamotte sandstone, surrounded by an area in which the Lamotte is present only in the lower portion of the buried valley system on the basement rock surface. The two areas are enclosed by a third in which the Lamotte is present everywhere except over the highest hills of the pre-Cambrian topography. An outer area in which the Lamotte blankets the basement rock surrounds the other three.

The major structural features include fold, faults, and basement rock knobs and ridges. Although the latter are physiographic forms, they are considered major structural features because they are essential to a definite structural environment. The Farmington anticline is the major fold feature. The major faulting includes the Ste. Genevieve, Simms Mountain, Palmer, Big River, Wolf Creek-Greasy Creek, Shirley, Black, and Berryman fault zones. The Flat River structural block is bounded by zones of faulting on the north, northwest, southwest, and south, and by an anticline on the east.

Three structural environments are recognized, and each has associated with it a distinctive type of lead ore body. The fault zone structural environment is characterized by an intricate pattern of many parallel, sub-parallel, and branching faults accompanied by a multitude of other fracture planes. The ore bodies in plain view have the long, narrow form common to vein deposits, but they have a restricted vertical dimension. They are along the fault zones, but rarely in the zone of maximum displacement. The knob and ridge structural environment is produced by the hills on the basement rock surface surrounded by sediments. The position of the local fracture system developed in the sediments adjacent to these physiographic forms is coincident with the position of the ore bodies. The deformation produced extensive fracturing and faulting of the sediments in that triangular segment of the crust which is the Flat River structural block. The ore bodies are the well known extensive disseminated deposits.

An attempt to decipher the structural history is hampered by the incomplete geologic record. After Middle Devonian, but before Mississippian time, magmatic pressure caused explosive blowouts through approximately 4000 feet of sediments. Upfolding and faulting attended this period of deformation. The release of magmatic force produced a low pressure chamber and downward settling of the crust may have followed. Collapse as a factor influencing the pattern of deformation cannot be ruled out, although its influence can be only speculative. Compressive stress in either late or post-Pennsylvanian time produced reverse faulting in the Ste. Genevieve fault zone, the en echelon pattern in the Big River fault zone, and movement along the Berryman fault.

Mining may be extended vertically and laterally. The possibilities for lateral extension are suggested by the size of the area that may contain favorable structural environments. The possibilities for vertical extension, especially downward, are suggested by the sandy dolomite lenses in the Lamotte, some of which are mineralized and have been mined at two places.

## ENGINEERING, SANITARY

### FUNDAMENTAL CONCEPTS IN GAS CLEANING WITH SPECIAL REFERENCE TO GASPHASE SEPARATION

(Publication No. 2669)\*

William Nemits Witheridge, Ph. D.  
University of Michigan, 1951

The effective treatment of a gas for the purpose of separating suspended matter provides both the opportunity and the necessity for collaboration of specialists representing numerous branches of science and technology. Progress in this field has been delayed by the lack of a well-organized approach to the analysis of special applications of gas cleaning mechanisms. The work represented here is an effort to provide an organized nucleus of concepts, nomenclature, and analytical technics for a relatively new field of integrated research and development.

Special significance is attached to the "Equilibrium Method of Analysis" presented in the first chapter. This approach has influenced many details in subject development, and is carried along by graphic and symbolic exhibits. Figure 1 illustrates this underlying theme at the beginning of the dissertation. Figure 28 illustrates its use in the summation of certain fundamental concepts relating to the exchange of matter between a carrier gas and its environment.

Gas cleaning is an engineering problem that implies an especial concern for minute quantities of matter conveyed by the gas from any treatment enclosure or conduit. Accordingly, many considerations dealing with effluent gas requirements and restrictions are discussed as a prelude to concepts on equipment design. Influence of the source of gas upon the nature of suspended matter is reviewed.

The broad field of mechanics has been searched for important concepts bearing upon the dynamics of separating particles from a

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gas. In this portion of the study, no limitation has been placed on the size of separable particles, which are considered to range in a continuous spectrum from molecular to macroscopic.

A new classification of gas cleaning functions and elements is presented, which features the distinction between separation and preparation objectives and mechanisms. The separation function is developed in detail as a combination of diffusional and deflectional mechanisms.

The specification of separation difficulty is presented in terms of a new transmission degree scale, and the use of this scale is developed for the analysis of complex multistage systems.

The general structure of mass transmission rate correlating expressions is presented. The exponential transmission coefficient is developed in a form suitable for any phase of matter dispersed in a gas. Separation and entrainment factors are differentiated, and diffusional mechanisms distinguished from inertial. To facilitate the representation of these features of gas cleaning systems, special symbols have been devised.

The use of logarithmic-probability graphs for analyzing the behavior of gas cleaning mechanisms is demonstrated, with particular reference to their fractionating tendencies against nonuniform aerodispersions.

The essential features of experimentation are reviewed by which performance data may be acquired under conditions most favorable to the correlation of physical principles. Attention is also directed to effective specification of gas cleaning equipment performance, and correct interpretation of performance measurements.

It is concluded that substantial gaps in fundamental knowledge are responsible for repeated failures in the application of gas cleaning equipment. At the same time it is evident that important misconceptions can be eliminated by expediting the exchange of technical information already available.

This work is viewed as a contribution to the interchange of information in a complex field of engineering endeavor, and to the continued development of a sound analytical approach to specialized gas cleaning problems.



## FORESTRY AND CONSERVATION

### THE SIGNIFICANCE OF WOOD-ROTTING FUNGI IN THE PRODUCTION AND UTILIZATION OF JACK PINE IN LOWER MICHIGAN

(Publication No. 2664)\*

Reed William Varner, Ph. D.  
University of Michigan, 1951

Comprehensive field and laboratory studies of decay were made in jack pine (Pinus Banksiana Lambert) to determine the amount of cull, its causes, and possible means of prevention in Michigan forests. Furthermore, the occurrence and growth of the fungi that produce defect in jack pine products were investigated.

As fruiting bodies of wood-rotting organisms were found to be rare on living jack pine, a technique (modified from a method used in Sweden by Rennerfelt) was devised for procuring cultures from standing trees. Eighty-six percent of the isolates obtained by this procedure in ten representative jack pine stands were identified as Fomes Pini (Thore) Lloyd. Polyporus circinatus Fr. and Lentinus lepideus Fr. were also obtained. Both F. Pini and P. circinatus had infected trees less than forty years of age and without evident wounds.

Five fungus species were successfully established in living jack pine by artificial inoculation. The rate and pattern of the rot caused by each organism during twenty-seven months were determined. Radial and tangential growth within the infected trees did not exceed 0.3 inch per year, whereas, annual longitudinal development was more than seven inches for some fungi. In spite of great variation in the amount of defect caused in individual trees by a given fungus, differences statistically significant at the 5 percent level were demonstrated among the mean rates of advance of the decay caused by the various species.

Tests with a benzidine reagent indicated that sapwood in the vicinity of a burned or otherwise injured area in a living jack pine tree undergoes certain chemical changes which appear to be similar to those that take place in the natural formation of heartwood. This altered sapwood may be subject to attack by heart-rotting fungi and thus supply an avenue whereby these organisms can gain entrance to the heartwood.

Although Fomes Pini present in standing trees remained alive in the heartwood of jack pine pulpwood during a storage test continuing twenty-eight months, little deterioration was caused by this organism subsequent to felling. Peniophora gigantea (Fr.) Masee was

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shown by both fruiting body incidence surveys and isolation studies to be the major cause of decay in the experimental bolts. The mean specific gravity loss in the test wood during the exposure was 15 per cent. The extent of the loss sustained increased with the proportion of sapwood present. The data suggest that substantial savings will be realized by selecting pulpwood with a minimum of sapwood for storage during extended periods.

A positive correlation with a level of significance of 1 percent was noted between the mean percentage of the linear feet of pulpwood in a storage pile with fruiting bodies of wood-rotting fungi and the mean loss in the specific gravity of the sapwood. Additional investigation in Lower Michigan may make possible a reliable estimation of the amount of fungus deterioration in pulpwood based upon sporophore incidence.

In laboratory decay tests, the fungi that were most commonly isolated from pulpwood caused more rapid decay in sapwood than in heartwood. Fungi characteristically in living trees, on the other hand, decayed sapwood and heartwood with equal rapidity.

Jack pine sapwood blocks infected with selected fungi did not sustain measurable weight losses after the moisture content of the wood was reduced to a point below fiber saturation. Many fungi, however, remained alive for eighteen months in wood with as little as 9 percent moisture. Under conditions of restricted water supply, organisms that caused brown rots resulted in consistently greater weight losses than those that produce white rots.

Optimum temperature for growth on malt agar for the fungi commonly attacking jack pine in Lower Michigan ranged from 20° C. for *Stereum sanguinolentum* Alb. to 35° C. for *Polyporus anceps* Peck. *Peniophora gigantea* grew at near its optimum rate on malt agar over a broader range of temperatures than any other fungus tested. The temperature-tolerance of this organism may explain, in large measure, its importance in pulpwood stored in the woods.

## FUEL TECHNOLOGY

### THE UNDERGROUND ELECTROCARBONIZATION AND GASIFICATION OF MINERAL FUELS

(Publication No. 2693)\*

Erich Sarapuu, Ph. D.  
University of Missouri, 1951

The development of underground gasification methods for recovering mineral fuels is comparatively recent and several methods have been evolved for treating the various source materials. The problem of recovering solid and liquid fuels by underground gasification in gaseous form was primarily approached by means of opening underground entrys which created the required fire-drift for starting the gasification in place.

Increasing knowledge of the whole problem of gasification in situ led to the evolution of new improvements in the underground gasification technique and, in the course of progressive research the preparations required for starting the gasification were accomplished from the surface. This procedure simplified the gasification and reduced the cost of the underground fuel. The trend of this development has been called "shaftless underground gasification."

The aim of this research was the investigation of the possibility to use electric current for underground gasification and carbonization purpose. The current passed through the fuel bed, which acts as a conductor, initiates the decomposition of original organic substance of the fuel. This phenomenon has been utilized for recovering various fuels like coal, oil shale and oil sand.

The process is called "Electrocarbonization" and is a shaftless gasification method.

The field experimentation was performed at the "Tiger" mine (Sinclair Coal Company), Hume, Missouri. On the bases of research data made available by 4 years of experimentation (from September, 1947 to May, 1951) embodied in this dissertation, it is believed that a large scale underground electrocarbonization and gasification pilot plant can be designed and operated successfully. The research has proved that gas suitable for domestic and industrial use can be produced physically and economically by the underground Electrocarbonization process. Further development of the process is largely the responsibility of industry.

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## GEOGRAPHY

### THE SOVIET CONSERVATION PROGRAM FOR THE STEPPE AND WOODED-STEPPE REGIONS OF THE EUROPEAN PART OF THE U. S. S. R.

(Publication No. 2571)\*

Joseph Andrew Baclawski, Ph.D.  
University of Michigan, 1951

The purpose of this study is to present a new approach to the Soviet program for the European steppe and wooded-steppe regions. The stated objectives of the program are to combat drought and increase production in one of the most important agricultural areas of the Soviet Union. On the basis of these stated, and widely publicized objectives, the feasibility of the program has been questioned in the non-Soviet world. None of the program's measures seem capable of increasing the quantity of precipitation, and a number of serious criticisms have been directed against the two basic features of the program — the recommended crop rotations with their stress on perennial grasses and legumes, and the afforestation plan. The heavy demands which perennial grasses and legumes make on soil moisture in semi-arid regions adversely affect the yield of the subsequent crop in the rotation. The limited value of shelterbelts and the likelihood of high mortality rates among the tree plantings appear to raise doubt as to the practicality of the entire program. Furthermore, there are certain irrationalities in respect to the distribution of the state forest belts, which are ostensibly designed to protect the agricultural regions from the hot, dry easterly and south-easterly winds.

These western criticisms appear to be the result of accepting the Soviet emphasis on the program's objective of combatting drought at face value, while the role that the control of soil erosion plays in the program is seriously underestimated. This study shows that erosion is a problem of major proportions in the European part of the Soviet Union. Quantitative estimates of the arable land being subjected to dangerous erosion range from 50 to 70 million hectares (124 to 173 million acres). The most severely eroded regions are to be found within the program area.

The Soviet erosion problem is serious enough to warrant vast expenditures of resources to check its further development and to rehabilitate the large areas of eroded soils. The October 1948 program appears to be a rational method of accomplishing these objectives.

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The inclusion of grasses and legumes in crop rotations is a basic soil conservation method. Forest vegetation is especially useful in protecting an area against erosion. The distribution of the state belts can be rationally explained as being designed to control erosion in critical areas.

For these reasons, it seems that the present criticisms concerning the suitability of the afforestation and crop rotation measures are not justified. The program can be interpreted as a well-rounded, if somewhat belated, plan for developing a permanent, intensive agriculture adjusted to the capabilities of the land. In a restricted sense, the Soviet propaganda may be correct in depicting the program as a campaign to end drought. But this drought is a man-made phenomenon, the result of the losses of water associated with the processes of accelerated soil erosion, to which the past land utilization policies of the Soviet government appear to have materially contributed.

SALT FROM THE SEA:  
A GEOGRAPHICAL ANALYSIS OF THE NATIONAL  
AND INTERNATIONAL PATTERNS OF JAPANESE SALT  
PRODUCTION AND TRADE

(Publication No. 2591)\*

John Douglas Eyre, Ph. D.  
University of Michigan, 1951

This study is a geographer's appraisal of the role of the salt industry in the economy of the Inland Sea region and in the economy and strategic considerations of the Japanese nation. Two significant facts form the basis of the investigation. First, Japan has no terrestrial salt deposits, so salt must be produced in primitive coastal fields using sea water. Second, salt extracted by such means is all consumed domestically, but is inadequate to meet national food and industrial demands. Consequently, Japan is dependent upon salt imports.

The geographical analysis follows two related lines of investigation. First, the factors that explain the present distribution and character of the domestic salt industry are examined. Although salt making units are scattered widely along the coastline, about 90 per cent of Japan's salt production is in the Inland Sea region. The author spent one year in field work in Japan studying the salt industry at local, regional, and national levels. Results of field research showed

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\* Microfilm copy of complete manuscript of 137 pages, \$1.71.  
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the concentration to be the result of historical developments, especially during the Tokugawa Period (1600-1868); relatively favorable climatic conditions and terrain features; a relatively efficient field system, operated by a large body of skilled workmen; and recent policies of the Monopoly Bureau. Each of these factors is discussed in detail. Many of the more critical points are illustrated by examples drawn from on-the-spot observations in the field. Maps and statistical tables supplement textual discussion.

The second line of investigation is to trace the areal relationships that have evolved between Japan and foreign sources of salt. Much of this part of the study is based on statistics and other data obtained from the Japanese Monopoly Bureau, which controls all salt production and trade in Japan. Assembled data show that Japan has been traditionally dependent upon Mediterranean and Red Sea countries for salt. Japanese imports mounted each year with the demands of an increasing population and an expanding chemical industry. World War II cut off trade with the former suppliers, and forced Japan to place greatest reliance on Far Eastern sources, especially in China and Formosa. However, these areas, controlled by military force, have been taken from Japanese control as a result of World War II.

The following conclusions have been reached. (1) It would be more economical for Japan to purchase all of its salt abroad, but Japanese planners feel that some domestic production even at high cost is better than total dependence on imports. Whether the traditional-type fields or some modification be used, the patterns of regional and national salt production in Japan will remain unchanged. (2) Japan cannot hope to produce enough salt to meet the food and industrial need of its rapidly increasing population. The only answer is continued dependence on heavy imports from countries where salt is made cheaply and in large amounts.

**THE CHAMPLAIN-RICHELIEU LOWLAND:  
A STUDY IN HISTORICAL GEOGRAPHY**

(Publication No. 2603)\*

Robert David Hodgson, Ph. D.  
University of Michigan, 1951

The purpose of this study is to show the effects of the cultural environment on the creation of a landscape. The Champlain-Richelieu Lowland of Vermont, New York and Quebec was selected for the study

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because it possesses a homogeneous natural environment and an economic environment which is very similar throughout. The first part of the study shows that the factors of the natural environment, climate, soils, vegetation and landforms, are the same, as much as is possible, throughout the entire lowland. The region, also, has been settled by two distinct cultural groups, the French-Canadian in the north and the New England in the south.

The study is both genetic and morphological in its method. Standard historical references have been used for the genetic section of the study. The data, however, have been presented in their areal relationships. As much data as possible have been presented in the map form. In the morphological analysis of the modern period, the author spent all of one summer and a part of another in the field collecting material. Because of the size of the area, type studies were made of a typical French-Canadian village and parish and of a typical New England village and town. These were likewise done in the field.

This study finds that, while the French-Canadians and the New Englanders have always utilized the land in the same general way, they have differed greatly in detail. In the actual settlement of the land, the French settled on the river bank, the New Englanders on the local heights. The French settled densely and continuously while the New Englanders settled sparsely and thinly. The French were interested in general farming with an emphasis on sustenance production. The New Englanders, after the development of transportation, were commercial producers. Interested as they were in commerce, the New Englanders selected the mill site as the location of their village while the French-Canadians grouped about the church. These tendencies have continued even into the modern landscape. The French-Canadians have, to a degree, abandoned some of their former ways to become closer to the New Englanders than ever before. Great differences still exist however.

The conclusions drawn by the author are that the natural environment will, with the economic environment, show one type of land use for which the region is the best suited. The landscape will be the cultural interpretation of this suggestion or limitation. It is significant to note that the changes which have occurred in the landscape patterns have been brought about by changes in the economic environment. The cultural environment, furthermore, etches the fine details on the land in the form of house types, village morphology and field patterns, among others, which give the landscape its individual character, its "personality." It is important, in this latter case, that the people concerned must want to preserve their cultural integrity and that no previous force exists to make it impossible for them to maintain their individuality.

## GEOLOGY

### THE GEOLOGY OF THE SIOUX FORMATION

(Publication No. 2520)\*

Walter Brewster Baldwin, Ph.D.  
Columbia University, 1951

Exposures of the Sioux formation lie in a belt less than 30 miles wide extending 180 miles from Mitchell, S. D., to New Ulm, Minn.; outcrops are poor. The formation, at least a mile thick, is in large part a sedimentary quartzite. It fits descriptions of the Uinta, Tintic, Prospect Mountain, and some Beltian quartzites of the western states, and the Baraboo and other quartzites of Wisconsin. The origin of the Sioux formation thus bears on the origin of other thick quartzites.

The typical quartzite is a pink rock made up of well-sorted, rounded, medium quartz sand, cemented by silica. The pink color is due to a dusty film of red iron oxide, probably residual, which coats and outlines the sand grains. The cement occurs as enlargement of the detrital quartz grains in typical quartzite and both as enlargement and as microcrystalline cement in argillaceous quartzite. Most of the exposures are typical quartzite, believed to form half or three-fourths of the formation. Argillaceous beds range from sandy mudstone to the soft, red, sericitic pipestone or "catlinite." Two conglomerates include pebbles of vein quartz, chert, and jasper; two outcrops of coarser conglomerates, possibly equivalent and basal, are also known.

The quartzite is characterized by bedding in parallel planes. Cross-bedding is common but limited to beds a meter thick or less. Ripple marks are common. Mud cracks, ripples, and clay galls are found in some argillaceous beds and a sun-crack pattern is present in typical quartzite.

The Sioux formation is preserved as a series of basins on the east-west axis of the Sioux uplift. The axes of the troughs and basins trend NNW to WSW. The beds dip  $3-7^{\circ}$  in nearly every outcrop; the maximum dips recorded are  $30^{\circ}$ . Faulting is inferred in only one area. The gentle structures and absence of secondary cleavage in the mudstones indicate that the formation has not been subjected to appreciable metamorphism. Dominant directions of jointing — N  $35-75^{\circ}$  W, N  $10^{\circ}$  W to N  $15^{\circ}$  E, and N  $50-70^{\circ}$  E — are not related to minor undulations in the basins but may be related to limbs of basins or to regional structure.

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The Sioux formation has been correlated with the Baraboo quartzite, in turn correlated with Huronian quartzites of the Lake Superior district. Correlation by lithology may be misleading because of the abundance of sedimentary quartzites. No undisputed fossils have been found, and on subsurface information the Sioux formation is pre-St. Peter and probably pre-Upper Cambrian.

The original sediment was derived from a thoroughly weathered upland to the north. Absence of clay and silt in much of the formation is ascribed to winnowing by wind. The sediment was finally deposited either under shallow water marine conditions or in a vast interior basin with temporary lakes; the former possibility is preferred. Absence of channeling and of dune-type bedding precludes an origin in other non-marine environments.

Cementation involved addition of silica in large amounts. This was accomplished before the Middle Ordovician; the Baraboo quartzite was cemented before the Upper Cambrian. A case for cementation during deposition of the sediment is presented. Silica was available at the time, and sea water is known to precipitate colloidal silica from stream waters. Banding of the iron oxide may have been the result of diffusion through a gel, and the "sun cracks" in typical quartzite may have formed by loss of volume of a dehydrating silica hydrosol.

#### DETERMINATION OF CRUSTAL STRUCTURE BY THE DISPERSION OF RAYLEIGH WAVES

(Publication No. 2626)\*

Edward James Moore, Ph.D.  
University of Michigan, 1951

This is a study of the dispersion of seismic surface waves for the purpose of determining the crustal structure in certain regions of the world together with the classification of those regions into continental or oceanic crustal types. The term "crustal structure" refers to the horizontal layering of relatively homogeneous material in the upper 30 to 50 kilometers of the earth. The regions investigated were the North Pacific, North America, the Gulf of Mexico, the Antarctic, the West Indies-Caribbean region, and the Central Pacific.

The periods and velocities of Rayleigh type surface waves were determined from a number of seismograms and the results plotted to give observed dispersion curves. These curves were compared

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graphically with dispersion curves derived from the classical theory of surface wave propagation in order to determine the layer thicknesses and velocities of shear waves in the crust. They were also compared graphically with other observed dispersion curves rated by the percent of oceanic type of path traveled by the surface wave from epicenter to recording station. This last operation was then balanced against the percentages of oceanic path obtained from measurements on bathymetric and geographic maps.

The results indicate a close correlation between the two methods of determining the type of crust traversed by the seismic surface waves, though in some cases to obtain a close correlation some assumptions must be made. Some of the factors which limit the effectiveness of this approach to the problem are discussed, such as the interference effect in surface waves, their arrival by least time refracted paths and the possible arrival of other seismic phases such as SS and SSS waves to obscure the onset of Rayleigh waves on the record. The effects of these and other factors on the determination of crustal structure by the graphical comparison method are also reviewed.

The conclusions drawn are:

1. The crust underlying the Caribbean Sea region and especially the Gulf of Mexico region seems to be of continental character.
2. The antarctic continent appears to be conventional continental material as one would expect, while the thickness of its polar ice cap does not have any detectable effect on the dispersion of surface waves with periods longer than 15 seconds.
3. There is some indication of a high velocity region in the central Pacific, between the Samoan and the Hawaiian Islands.
4. A portion of the Arctic ocean appears to be underlain by truly oceanic type crust.

## HISTORY

### SCIENCE AND HUMANITY IN PHILADELPHIA 1775-1790

(Publication No. 2499)\*

Whitfield Jenks Bell, Jr., Ph.D.  
University of Pennsylvania, 1947

Philadelphia between 1775 and 1790 was indisputably the greatest city of America, the second or third largest in the British empire, the

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first Athens of the West. Wealth and a certain cosmopolitanism, together with Quaker tolerance, prepared ground in which the arts and sciences flourished; while the American Revolution, with its nationalistic implications, gave them new impetus and direction.

The prevailing ideology was that of republican virtue. Philadelphia Catos exalted the qualities of simplicity, moderation, and patriotism. They considered themselves obligated to praise the rural life, to dress plainly, and to live temperately. From these sentiments the agricultural, manufacturing, and temperance societies derived a part of their strength. But republicanism, though it might be reckoned in the order of nature, needed to be taught to a new generation. Thus it fell out, that post-war education — or, at least, post-war educational theory — had a large nationalistic element in it.

But narrow nationalism was no essential part of the enlightened Philadelphians' minds. As citizens of a world center of the Enlightenment, they were in uninterrupted contact with scientific, medical, and humanitarian reforms and reformers abroad, giving as good as they received. Their observations of the transit of Venus in 1769, for example, their studies of American botany, the data their anti-slavery societies gathered instructed Europe, even as Europe provided the pattern for the Philosophical Society, the prevailing theories in medicine, and a stimulation to gardening. And in this exchange Philadelphians considered themselves and were considered by others the chief American cultural community, with an obligation to direct and disseminate scientific and humanitarian investigation and information in this country.

What a study of the cultural life of Philadelphia in these years clearly reveals is (1) that Philadelphia was part of the great web of the international Enlightenment, (2) that scientific and humanitarian movements, no less than political institutions, were affected by what Dr. Benjamin Rush chose to distinguish as the American War of Independence and the American Revolution, and (3) that, however "critical" this period may have been in other respects, in cultural matters it was robust and confident.

APPRENTICESHIP FOR THE PRESIDENCY:  
FRANKLIN D. ROOSEVELT AS GOVERNOR OF NEW YORK

(Publication No. 2521)\*

Bernard Bellush, Ph. D.  
Columbia University, 1951

New to the game of politics, young Franklin Roosevelt was elected to the State Assembly in 1910, as a Democrat from a Republican stronghold. Although a comparatively enlightened legislator, he did not actively direct the struggle for social welfare legislation. Roosevelt was re-elected in 1912, with the aid of Louis Howe, only to resign a few months later to become Assistant Secretary of the Navy. In Washington he helped direct the nation's efforts toward military preparedness, and then shared leadership of United States naval efforts in World War I. He came into contact with New Freedom ideology, and numerous party leaders, which helped gain him the Democratic Vice-Presidential nomination in 1920.

Following the disastrous Democratic defeat in 1920, Roosevelt returned to private law practice. Infantile paralysis, in 1921, changed his life's habits, though not his objectives nor political interests. His efforts to secure the Presidential nomination for Alfred E. Smith culminated successfully at the Democratic Convention in 1928.

Over Louis Howe's objections, Roosevelt was drafted for the New York gubernatorial race in 1928, which he barely won while Smith was suffering defeat. As Governor, Roosevelt attained unusual success alleviating many rural tax, school and road problems, through his self-appointed Agricultural Advisory Commission.

The severe depression which commenced late in 1929 uncovered, through numerous bank failures, the need for fundamental reforms in banking laws, and increased supervisory powers to the State Banking Department. Governor Roosevelt and Robert Moses encountered severe opposition from the financial world in their banking reform efforts.

The 1930 gubernatorial contest witnessed the highly developed political machine of Roosevelt, Howe and James Farley crush the Republican Party in urban and rural areas, aided by the impotency of the national Republican administration in the face of the intensifying depression.

Public relief, via State financial aid to communities, reduction of rural taxes, increased employment on State construction projects, and the efforts of the Temporary Emergency Relief Administration,

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under Harry Hopkins, partially relieved the crisis in many areas. Unemployment insurance was eventually fostered by Governor Roosevelt through speeches, an interstate conference of Governors, and by appeals for its enactment to the State Legislature. Care for elders, through old age pensions, was sponsored by Franklin D. Roosevelt. Legislative-Executive struggles finally resulted in enactment of a watered down version of the original proposal.

Commencing with his gubernatorial race in 1928, FDR increasingly leaned upon labor for votes and year-round support. His sponsorship of legislation favorable to labor insured him increasing support from the working population.

Throughout his four years as Governor, Roosevelt constantly battled the utility interests. The latter opposed stricter regulation by the Public Service Commission, state ownership of the manufacture and distribution of cheap electric power, and the development of the long-debated St. Lawrence River power project.

With the approach of the 1932 national conventions, Governor Roosevelt was faced, on one hand, with divulgements of extensive corruption and graft in New York City by the Seabury investigation and, on the other, by his desire for Tammany support for his Presidential aspirations. He removed the Sheriff of New York County from office, whereas Mayor James J. Walker resigned before final decision could be rendered in his case.

Finally, during the 1932 Presidential contest, Democratic candidate Roosevelt, through his campaign addresses, tended to illustrate the links between his work as Governor, in the fields of labor, agriculture, social welfare legislation, banking, finance and utility control, and that which, to a great extent, he advocated during his first term as President.

THE AMERICAN SYSTEM; AN EXAMPLE  
OF AMERICAN NINETEENTH-CENTURY ECONOMIC THINKING  
— ITS DEFINITION BY ITS AUTHOR, HENRY CLAY

(Publication No. 2524)\*

Robert Wilson Binkley, Jr., Ph.D.  
Columbia University, 1950

In its simplest form the American System was a scheme whereby the American people would be molded into a unified and self-sufficient nation. While often described as a tariff policy to encourage industry, in reality it was more inclusive than a mere program of

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import duties. Interwoven into this tariff program, to be sure the cornerstone of the system, was a program of road and canal construction to be effected by the federal government; a national bank program to stabilize the national currency; and a land program designed to try to achieve an economic balance between the agricultural and nascent manufacturing interests of the country. In total it was clearly a plan to create an autarchic nation, each section dependent upon and closely intertwined with the others.

The American System was not suddenly announced as an entirely new idea by its leading advocate, Henry Clay of Kentucky. Indeed its final form did not emerge into a unified plan until the 1830's although elements, presented separately from time to time, had been part of our legislative history since 1816 during Clay's earlier years in Congress. Clay himself was of course influenced by his environment; this was composed primarily of the United States with its predominantly rural society and agricultural economy; of economic thought as it had begun to develop in America, beginning to leave the paths of English Classicism and striking out on its own; and of Kentucky, his adopted state, faced with numerous new problems and trying to solve these locally if possible.

Clay's own individual programs were hardly original; he borrowed ideas where he found them in agreement with his own. Alexander Hamilton's widely read and highly respected reports on manufacturing, and on banking often supplied sound argument for his use. And Gallatin's masterly road and canal (internal improvement) report to Congress was used to advantage. Clay's major contribution was found in his moulding these several thoughts into a broad and comprehensive plan, a plan which envisioned the U.S. as economically independent of the rest of the world, free from any foreign and unsavory influences, at liberty to develop into a powerful and respected nation of Americans without any outside assistance or interference.

As a coordinated plan the American System never became a part of the American scene during Clay's lifetime. Despite his own personal popularity, equalled only by Andrew Jackson in his own day, Clay could never achieve his ideal in Congress. While every Congress did pass tariff legislation; while each did extend the internal improvements of the country; while the Bank of the United States was made and unmade; and while the federal land policies were structurally altered only in details; still the total plan did not result. For as one program would come close to Clay's idea of sound action, another would be allowed to fall into oblivion or would be changed so much that Clay would not accept it. Thus the parts never added up to the whole, and the results Clay envisioned were never realized.

In 1840 it appeared that the golden opportunity had arrived. The party which Clay, more than any other person, had molded together from numerous sources had at last elected a President and a friendly

Congress. But Harrison lasted only a month; and while Clay — called the "Old Dictator" by his enemies — did receive majorities in Congress he could not override Tyler's vetoes. It became apparent that the Whigs were not really followers of Clay's American System; they were simply anti Jackson and his entourage. And with the issues of slavery becoming increasingly important, Clay gave second place to the American System, his main interest about 1845, turning his attention to the issue of Union and the Compromise of 1850.

The elements of the American System however did not die. The various programs were picked up and put together by a Whig from Illinois, long a Clay supporter, Abraham Lincoln. But the System as adopted by the Republican Party was different from that of Henry Clay; it excluded the South, something which was partially responsible for his failure to bring into fruition his System. Nevertheless the American System is of significance because it was the first systematic attempt to construct a comprehensive plan for the nation in the youthful days of its economic and political development.

#### **GUNS OVER THE BORDER: AMERICAN AID TO THE JUÁREZ GOVERNMENT DURING THE FRENCH INTERVENTION**

(Publication No. 2575)\*

Robert Benaway Brown, Ph. D.  
University of Michigan, 1951

This is a study of the aid given by the United States to the Mexican government of Benito Juárez during the period of the French Intervention.

Emphasis is placed upon the material aid furnished by private citizens and by agencies of the government rather than upon the diplomatic endeavors of the period.

The activities, successful and otherwise, of the principal Mexican commissioners are traced, as is the part of Matías Romero, Mexican minister to Washington during the period. American leaders are also considered, together with estimates of their contributions.

Juan Bustamante, the first important commissioner, is found to have contributed little, save enlightenment as to the attitude of the North American government, which was highly reluctant, in the face of possible French recognition of the Confederacy, to alienate the French. Placido Vega, governor of Sinaloa, working on the West Coast, sent off some loads of arms and materiel. The expedition

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he personally led to the aid of the Juarista cause miscarried. Gaspar Sánchez Ochoa, working on both coasts, sent off the Brannan Contingent the basic element of the Legion of Honor, an all-officer company of North Americans serving Juárez. Ochoa then joined the Ortega party, assisted in the first major attempt to recruit North American armed aid in the east, and accomplished no more.

José María Jesus de Carvajal, governor of Tamaulipas, and his friend General Lew Wallace succeeded in floating a bond issue in New York, with which General Herman Sturm managed to buy a considerable amount of arms and equipment. Wallace organized a volunteer expeditionary force, an element of which seized the Rio Grande port town of Bagdad, but his principal plans fell through when Carvajal lost his position as jefe of Matamoros. Sturm's ships of arms and ammunition, with the exception of one which foundered, reached the Juaristas, and helped arm Generals Escobedo, Díaz, Regules, Beriozábal, and Pavon, among others.

The leaders of the United States Army fostered an armed intervention in Mexico, but were frustrated by the diplomacy of Secretary of State William Henry Seward. General U.S. Grant, ardent Mexican partisan, managed to get much used army materiel to the Juaristas through General Phil Sheridan, commanding on the border. Sheridan's 100,000 man army of observation also forced caution on the Franco-Imperialist forces of Maximilian and Napoleon III.

The general conclusion, as to American aid to Juárez, is that Prussian strength in Europe as manifested in the Battle of Sadowa was probably more influential in terminating the Intervention, but that without American aid, the government of Juárez would not have survived until that influence could be felt.

#### SOME CONTROVERSIES ON CHINESE CULTURE AND EDUCATION

(Publication No. 2526)\*

William Juntung Chen, Ph. D.  
Columbia University, 1951

The present study undertakes to examine three of the important intellectual controversies concerning Chinese culture and education that arose in China between 1912 and 1937. The period chosen extends from the founding of the Republic to the beginning of Japanese hostilities. This was a period when China experienced the full impact of Western civilization and technology. These controversies

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were the result of a series of attempts by Chinese intellectuals with varying viewpoints to search for formulae for the solution of fundamental Chinese problems and for methods of readjustment to unprecedented social changes.

Writings of Chinese intellectuals concerning the attitude to be taken toward Eastern and Western civilizations, toward old and new schools of thought, and toward the relationship between education and politics, have been surveyed, analyzed, and classified to gain a genuine reflection of the Chinese mind toward these issues. The social and economic conditions which gave rise to these controversies have been briefly reviewed, but not made the subject of special investigation or research. The study will be valuable for an understanding of the problems themselves as well as the development and trend of modern Chinese thought in these areas. Source materials are confined to the original writings of Chinese leaders, and are mostly drawn from Chinese magazines. Every attempt has been made to present a balanced study of representative opinion relative to the three controversies selected.

The first controversy studied was that involving Eastern and Western civilization. This controversy was generally focused on three questions. What are the fundamental differences between Eastern and Western civilization? What attitude should be taken toward the two civilizations? What solution of the problem should be adopted? A wide diversity was exhibited in the answers to these questions. It was, however, generally felt that Chinese traditional civilization was inadequate for the modern world, and that selective absorption of foreign culture was indispensable to enrich and refit Chinese civilization for modern life. But the question as to what to absorb, how much to absorb, and how to absorb still remains a problem.

The second controversy studied dealt with the conflict between old and new schools of thought. This conflict consisted of a clash between certain progressive intellectual leaders and the upholders of the traditional values and way of life. In the search for fundamental solutions of social and national problems, the progressives held the conviction that to face the modern world with an ancient mentality was disastrous, and they therefore called for a critical, scientific, and rational attitude toward all values, and emphasized, in particular, democracy, freedom, and respect for human rights. It was in order to clear the way for these new ideals that they attacked unrelentingly every old institution, especially Confucianism and the literary style of writing, both of which had enjoyed a long history of respect.

The third and last controversy studied was that of the relationship of education to politics. Two main phases of this problem were involved in the controversy; namely, the issue over the use of

education as a political instrument and the issue over the control of private schools. Political disintegration in the earlier days of the Republic not only gave rise to the development of the trend toward extricating politics from education, but led to an actual experiment with the independent control of education. However, arguments favoring the co-ordination of education and politics proved decidedly stronger than those against the proposition, and eventually took the lead. The controversy over the control of private schools was complicated by religious and international factors. However, since most Chinese educators resolved the relation of politics to education by asserting the inseparability of the two and affirming the use of education as the handmaid of politics, provided government was exercised in the interests of the welfare of the people, it followed that most of the intellectual leaders came to believe that private schools should be incorporated within the overall government system of education.

#### THE PROBLEM OF UNEMPLOYMENT RELIEF IN FRANCE DURING THE REVOLUTIONARY EIGHTEENTH CENTURY

(Publication No. 2502)\*

Vernie Clinel Francesco Clinch, Ph. D.  
University of Kansas, 1949

One of the most important problems of social pathology is unemployment. A study of the attitude of the state towards the question of responsibility in counteracting unemployment is an interesting one from many angles. This problem has present as well as future pertinence. It is of primary importance not only because of similar current problems in England, France, Spain, Germany, Italy, and more immediately in the United States, but also because it may throw some light on the techniques which may be used in dealing with the problems of unemployment and readjustment which have followed the recent global war. There is too common a tendency, particularly today, to assume that this is a new problem and one which calls for a "new deal." This is a dangerous assumption since it fails to look at the problem as a whole historically. In addition, it misses all of the valuable lessons taught by past experience. Therefore, the subject needs to be viewed in its historical perspective in order to offset the ordinary notion that our present problem is relatively unique.

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Placing the subject in its historical perspective, reveals that some of the attempted solutions in the Eighteenth Century are not unlike those that have been or are now being tried today. While this study is not solely limited to the Eighteenth Century, its concentration will be on the late Eighteenth Century in France. The principal divisions of this study are:

1. A survey from the Middle Ages to the beginning of the 18th century.

2. The Pre-Revolutionary Era, 1740-1789.

3. The Revolutionary Era and State Control, 1789-1814/15, embracing

The National Constituent Assembly, 1789-1791

The National Legislative Assembly, 1791-1792

The National Convention, 1792-1795

The Directory, 1795-1799/1800

The Napoleonic Period, 1799/1800-1814/15

Some of the important persons whose contributions are treated in this study of government responsibility and unemployment are: Cantillon, Diderot, Quesnay, Turgot, La Rochefoucauld-Liancourt, Prieur de la Cote d'or, Lavoisier, Chaptal, and Francois de Neufchateau.

The period directly preceding the call of the Estates-General was characterized by a great deal of agitation for constitutional action and government responsibility in relieving the condition of the unemployed. The "cahiers" provided a wealth of material dealing with the problems of mendicancy, chomage, and resulting unemployment. All tended towards pointing out the responsibility of the state in this matter. The constitution which the National Constituent Assembly adopted made provision for a general foundation of public relief for aiding the infirm poor, rearing foundlings, and providing work for those who, themselves, were unable to find it.

Having received this dictated obligation, the National Legislative Assembly went forward with a program of public relief on a broad national scale. Decrees were enacted and appropriations made for assistance and the creation of work projects for the unemployed. These projects consisted chiefly of construction and repair of roads, clearing river banks, reforestation, street cleaning, improving harbors, draining marshes, and digging canals. There were spinning and sewing shops for the women. Viewed as a whole these projects are roughly comparable to the type of "work-relief" attempted in the United States during the early years of the administration of the late President Franklin D. Roosevelt, particularly as carried out under the Civilian Conservation Corps and the Public Works Administration.

The National Convention's program resulted in the nationalization of this social-responsibility through the Comité de Salut Public

and the levée en masse of 23 August, 1793. Under the Directory, further steps were taken to combat unemployment. Under the leadership of Napoleon, much employment was created by his huge program of public works.

Throughout this study attention has been called to present-day applications of the unemployment problems and experiences of Revolutionary France in the Eighteenth Century.

#### THE ANTISLAVERY MOVEMENT IN ILLINOIS: 1809-1844

(Publication No. 2582)\*

Merton L. Dillon, Ph. D.  
University of Michigan, 1951

The Northwest Ordinance was interpreted in Illinois as a guarantee of the heritage of slavery received from the period of French occupation. Under the territorial government a system of indentures authorized the introduction of Negroes who were held in virtual slavery. Although the population of the state before 1824 was made up principally of people who were friendly to slavery and even favored its introduction into Illinois, a few persons had already arrived from the South, the North, and Europe who opposed slavery because of its incompatibility with the law of nature and the law of God.

It was such men, notably Edward Coles, Morris Birkbeck, and John Mason Peck, who led the opposition to the attempt made in 1823-1824 to call a constitutional convention for the purpose of introducing slavery. During the long contest, practically every argument against slavery which was to be used by the later abolitionists appeared. The antislavery societies which were formed at that time opposed slavery both on economic and moral grounds; eventually they were nominating their own antislavery candidates for public office.

In the period immediately after 1824, projects for the colonization of free Negroes attracted the support both of humanitarians who thoroughly hated slavery and of persons who had more selfish reasons for supporting them. Colonization before 1834, however, was not generally recognized in Illinois as a hindrance to the eventual abolition of slavery.

During the early period of statehood and after, large numbers of people came to Illinois from the South specifically to escape from a slave society. This group furnished many of the leaders in the Illinois antislavery movement. At the same time, Northerners entered Illinois, bringing with them religious ideas which assured their opposition to slavery.

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The most direct source of antislavery ideas for Illinois was Elijah Lovejoy's Observer. Lovejoy, however, did not create the antislavery movement in Illinois. Rather, the close relations he developed with influential men in Illinois, particularly clergymen, led to their adherence to him and his cause when his civil rights were imperiled. The failure of the respected elements in society to guarantee to Lovejoy the protection of his constitutional rights was as directly responsible for the mob action against him and his press. After 1837, the opposition in Illinois to slavery was closely connected with the defense of freedom of speech and of the press.

The state antislavery society, organized in 1837, was constantly plagued by a lack of money, difficulties in maintaining a press, and inability to secure lecturers. It obtained a press when Benjamin Lundy settled in Putnam County. Lecturers were eventually secured, principally from among the former associates of Theodore Dwight Weld.

A part of the antislavery element in Illinois by 1840 was ready to abandon moral suasion in favor of direct action in the forms of aid to fugitive slaves and independent political activity. A higher-law theory was developed to justify these new policies.

#### THE PUBLIC LIFE OF CONGRESSMAN RICHARD PARKS BLAND

(Publication No. 2681)\*

Harold Alanson Haswell, Jr., Ph. D.  
University of Missouri, 1951

The last thirty years of the nineteenth century was a period of great political unrest in the United States. The Civil War had created many vexing problems which perplexed the lawmakers throughout the period. Transitions were occurring in the fields of industry and agriculture which required major adjustments in the realms of finance, labor, and transportation. As corporate industry expanded, the interests and political aspirations of the industrial Northeast clashed with the agrarian politics of the West and South.

At no point was the conflict more pronounced than in the area of monetary policies. The East was determined that all currency should be interchangeable with gold. The West and South were equally desirous of expanding the nation's monetary base through the medium of paper currency or silver. The advocates of inflationary paper currency were never able to challenge seriously the "sound money"

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forces; however, the silver leaders were much more successful in their efforts to increase the per capita circulation through the coinage of silver. The struggle over the utilization of silver as a monetary metal was one of the major political issues for more than two decades. Congressman Richard P. Bland, of Lebanon, Missouri, was one of the first legislators to champion the cause of silver. His quarter century as a member of the House of Representatives almost exactly parallels the struggle for free coinage of silver. Throughout the entire period Bland was the recognized leader for the cause in the House.

Little is known of Bland's personal life. He left no reminiscences, and practically all of his personal papers have been destroyed. Consequently this study is based primarily upon official Government documents, newspaper accounts, periodicals, biographies of Bland's contemporaries, interviews with Ovid Bell, of Fulton, Missouri, who was Bland's last secretary, and a memorial volume published by W. V. Byars the year after Bland's death. Practically all of the source material is on file in the General Library of the University of Missouri.

A few months before Bland began his Congressional career, Congress passed an act which dropped the silver dollar from the list of the nation's coins. Since silver had been over-valued for several decades few silver dollars had been coined. Little was thought of the incident at the time. With the discovery of vast silver deposits in the West, silver became more abundant. At the same time the United States experienced a general depression which caused a contraction of currency. The debtor classes began to demand relief from the appreciating gold standard.

Through Bland's influence Congress passed the Bland-Allison Act of 1878, which committed the Government to the coinage of \$2,000,000 worth of silver each month. Twelve years later this bill was replaced by the Sherman Silver Purchase Act. Bland opposed this latter bill because it repealed the coinage clause and reduced silver to a mere commodity. Nevertheless, in 1893 Bland fought even more desperately to prevent the repeal of the Purchase Act unless it should be replaced with free coinage. He failed in both efforts.

As leader of the silver wing of the Democratic Party, Bland was seriously considered as a candidate for the Presidency in 1896, when the money plank became the primary issue in the campaign.

Although Bland continued to advocate free coinage until his death in 1899, the silver issue had practically died by the turn of the century. The vast increase in the production of gold which followed the discovery of rich deposits in the United States, South Africa, Australia, and Alaska, gave the American people an expanded currency. Bland's objective had been accomplished without the aid of legislation.

## FUNERARY STELAE FROM KOM ABOU BILLOU

(Publication No. 2605)\*

Finley Allison Hooper, Ph.D.  
University of Michigan, 1951

This paper is a study of one hundred and ninety-four stelae which are now part of the collections of the University of Michigan Museum of Archaeology. These monuments were recovered in 1935 from the site of the ancient Egyptian city of Terenouthis, now known as Kom Abou Billou, which is located about forty miles northwest of Cairo. The stelae are slabs of limestone usually rectangular in shape and measuring on the average about 35 by 25 centimeters. They include scenes sculptured in relief on the upper portion and inscriptions at the bottom. Hollow relief was usually employed and with few exceptions the design presents the deceased either standing with hands upraised or reclining on a couch with the right hand holding out a cup as if offering a libation.

A detailed description of the stelae is given in a catalogue which follows the pattern customary for such materials. Their various types, their religious symbolism and their inscriptions are discussed in special chapters. The style and subject matter of the ornamentation are treated in their relation to both the Egyptian and Greek traditions in funerary art. Forms from these traditions were incorporated into the various designs. They had become highly conventionalized, however, and their presentation retained the formality of the old Egyptian style. The religious symbolism is also primarily in the Egyptian tradition.

This collection containing the largest group of stelae from this provenance provides a wealth of examples unavailable to others who have studied similar reliefs. These show, however, very simple designs and a lack of the symbolism or elaborate decorations characteristic of later Coptic art. Yet they do present certain forms which provide artistic continuity from pagan into Christian times.

The inscriptions are of no religious significance. They are almost exclusively in Greek and as a rule very short. They supply, however, sufficient demographic data to show that the average length of life in this area was about the same as for Egypt as a whole during the Graeco-Roman period.

Numismatic and epigraphical evidence proves that these stelae belong to the last quarter of the third and the first half of the fourth

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century of our era. Thus we see the customary way in which those living in this locality commemorated their dead during that period. In addition, as a highly conventionalized local product they substantiate the generally accepted viewpoint with respect to the low artistic standards of these times in Egypt. Yet their chief significance is that they show how the age-old association between a representation of the deceased, his name and food offerings at his tomb was continued into the final days of paganism and how the formal Egyptian style lasted to this late date.

**THE COMUNERO REBELLION OF NEW GRANADA IN 1781,  
A CHAPTER IN THE SPANISH QUEST FOR SOCIAL JUSTICE**

(Publication No. 2616)\*

David Phelps Leonard, Ph.D.  
University of Michigan, 1951

Most of the previous studies of the Comunero Rebellion of New Granada in 1781 have interpreted it as a deliberate though unsuccessful movement for political separation from Spain. The purpose of the present work is to demonstrate that the revolt was a popular protest against specific abuses connected with the imperial reforms of Charles III and a demand for a larger share in the government of their country.

The first part of the study describes the background in Spain and America in terms of three basic factors inherent in the cause and nature of the revolt. First, the Bourbon program of imperial reforms intended to restore Spain to the ranks of the great powers. Second, the nature of the Hapsburg colonial system and the failure of the Bourbon reforms to meet the needs of the colonists. And third, the tradition of popular resistance to obtain redress of grievances. The second part deals with the development of the revolt from spontaneous rioting into an organized movement, leading to the settlement at Zipaquira. A detailed analysis of the articles of Zipaquira shows that the people, with no thought of disloyalty, sought to remove the high taxes and administrative abuses in the government of New Granada, which they could not believe represented the true policy of their sovereign. The analysis demonstrates that the Creole leaders of the revolt also wanted these reforms but that even more they wanted recognition of their rights as Spaniards and acceptance of their social and political equality with European Spaniards. The

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final part of this study consists of a reexamination of the thesis advanced by Manuel Briceno and other historians that the commissioning of agents to obtain arms from Great Britain establishes the separatist character of the Comunero revolt. In the light of re-interpretation of the known facts and of new evidence presented, this theory is shown to be untenable.

Neither the Comunero masses nor their Creole leaders desired separation from Spain in 1781. The revolt was against specific injustices in the colonial regime and a declaration that the Spanish people of New Granada would not tolerate monopolization of their country by and for European Spaniards. Consequently, the historical importance of the revolt lies in its character as a demand for political and social justice within the Spanish Empire rather than as a precursor of independence. It was the failure of the Spanish authorities to remedy the injustices or extend self-government in the colonies that makes the Comunero revolt a significant antecedent of the independence movement of 1810.

**THE EXPEDITION OF MAJOR GENERAL JOHN VAUGHAN  
TO THE LESSER ANTILLES, 1779-1781**

(Publication No. 2620)\*

Robert Neil McLarty, Ph.D.  
University of Michigan, 1951

Between February of 1778 and December of 1780, France, Spain, and the Netherlands entered the War of American Independence against Great Britain. Although the British were weaker than the combination against them, they attempted to defend their possessions everywhere and to carry out offensives in North America, Central America, and the West Indies. Two expeditions were sent to the Lesser Antilles. In 1778 Major General James Grant gained an important base by capturing the French island of St. Lucia. In 1779 Major General John Vaughan was expected to cripple France and Spain by an attack against their Caribbean possessions. This study, based upon the correspondence of Vaughan and his associates, has been undertaken to determine the purpose of the latter expedition and to explain how the general sought to execute his instructions.

Vaughan was first directed to capture the Spanish island of Porto Rico. If that appeared impossible, he was to regain the

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British islands that had already fallen and to annoy the enemy as best he could. Although his army was too small to attack Porto Rico successfully, the general made plans to recapture St. Vincent from the French and to take Trinidad from Spain. The presence of a superior enemy fleet, however, prevented him from undertaking any offensive during the spring and summer of 1780, and the threat of hurricanes precluded action during the fall.

Vaughan, therefore, was inactive throughout most of 1780. During that period many of his men died from disease. The British government was unable to furnish adequate replacements. At that time also a number of disputes occurred between military officers and the civil governors of the islands, which resulted from the failure of the secretary of state to limit the authority of the latter in military affairs.

In December of 1780 British naval supremacy was restored in the Lesser Antilles by the return of Admiral Sir George Brydges Rodney. An attempt to recapture St. Vincent failed, however, because Vaughan thought his army too weak to storm the fortifications. In January of 1781 the arrival of men and ships gave the British commanders a respectable force, but before they could plan an assault, they were ordered to attack the Dutch island of St. Eustatius, where a colony of merchants traded with Great Britain's enemies. The attack succeeded, and other Dutch colonies fell easily, but, while Vaughan and Rodney remained at St. Eustatius to confiscate the goods of the traders, a superior enemy fleet arrived in the Lesser Antilles. The French captured Tobago but failed against St. Lucia. Continued enemy naval supremacy kept Vaughan from further action. He sailed for England on 1 August 1781.

Vaughan failed to achieve important success because the wide dispersion of British manpower robbed him of an adequate army. As a result he could not attack the well-defended colonies of France. Most important, however, was the failure of the British to contain the enemies' navies in European waters. This deprived him of vital naval support. These errors of his government prevented Vaughan from undertaking an offensive of consequence.

**THE GRANGER LAWS A STUDY OF THE ORIGINS OF STATE  
RAILWAY CONTROL IN THE UPPER MISSISSIPPI VALLEY**

(Publication No. 2624)\*

George Hall Miller, Ph.D.  
University of Michigan, 1951

The purpose of this study is to explain the economic, legal and political origins of a series of railroad rate-control laws of the states of Illinois, Iowa, Wisconsin and Minnesota passed between 1869 and 1874. Historians have usually dealt with these measures as products of the agrarian upheaval known as the Granger movement. An effort has been made in this study to place them in the broader context of legal and political development resulting from the impact of a new form of transportation on an expanding society. The conclusions reached are based almost entirely upon published materials.

Chapter One deals with the economic consequences of the coming of the railroad and explains the growth of abuses in rate making practice. Chapter Two describes the common-law background of rate regulation, explains the inability of the courts to deal with the new forms of abuse, and gives a brief account of Eastern efforts to reform the law prior to 1873. Chapter Three discusses the mid-nineteenth century conflict between the legislative police power over prices and state policies of industrial and commercial promotion which made the imposition of effective controls such a difficult task. In the same section an effort is made to reconcile the movement for government regulation with prevailing theories of political economy. In the following four chapters the legislative history of each of the Granger laws is discussed in detail. A final section deals with the relationship between the Granger movement and the Granger laws.

The Granger laws were designed primarily to prevent certain forms of personal and local discrimination practiced by railroad companies of the upper Mississippi Valley in the fixing of their rates. They were regional manifestations of a nation-wide movement to adjust the existing law of carriers and highways to the requirements of competitive railroad service. The movement for reform in the upper Mississippi Valley, as in the East, was hampered by the fear of unserved communities lest restrictive controls prevent further capital investment in new construction. There was very little opposition to government control on the grounds of constitutional rights unless charter contracts were involved.

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The leadership of the movement came originally from shippers and business men in the communities affected by rate discrimination. The farmers, as a class, were late comers and did not significantly alter the substantive or procedural aims of the movement. Despite the cry of radicalism which arose after the adoption of the laws, the Granger railroad acts contained few legal and administrative principles not already in effect in one or more Eastern states. Their most important contribution was the system of judicial review and commission control adopted by Illinois in 1873 and copied by Minnesota and, in part, by Wisconsin in 1874. This system was a positive concession to the railroad interests. The Iowa maximum-rate law of 1874 and the similar sections of the Wisconsin act of the same year, were clearly in the tradition of legislative regulation of business enterprise as practiced by the American states during the ante-bellum period.

**ERIE'S JUNIOR PARTNER**  
**THE ECONOMIC AND SOCIAL EFFECTS OF THE CHAMPLAIN**  
**CANAL UPON THE CHAMPLAIN VALLEY**

(Publication No. 2548)\*

John Edward O'Hara, Ph. D.  
Columbia University, 1951

The Champlain Canal connects the South Bay of Lake Champlain with tidewater at Waterford, New York. The canal was begun in 1792 but the lack of funds and the inability to secure the services of a qualified engineer forced the suspension of operations in 1797. It was not until after the close of the War of 1812 that the project was resumed and successfully completed in 1824.

Prior to the opening of the Champlain Canal, the only profitable route to market for the Champlain Valley was through the Richelieu and St. Lawrence Rivers. With both the highways and markets in foreign hands, the valley's economy was precarious. The opening of the canal, however, brought to an end the economic orientation of the valley to the St. Lawrence.

A new era burst forth upon the valley with the completion of this new channel. Mining, quarrying, agriculture, transportation, and lumbering felt the impetus. The canal not only threw open the flood gates that unleashed a tide of prosperity but it completely revolutionized navigation on Lake Champlain. Although steam boating on the lake began

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as early as 1808, no noticeable development took place until after the completion of the canal. Within a short time sailing vessels were driven from the lake. On the canal, rivalry between packet lines knew no bounds. This competition forced the majority of the lines into bankruptcy.

It was the opening of the canal that permitted the exploitation of the rich iron deposits of the valley. What was true in the iron business was equally true in the other extractive industries, particularly quarrying. The saw mills in the valley operated day and night while the clamor of the hammer and saw in the shipyards played an endless tune. Lumber and massive timbers which had formerly sought the Quebec mart now turned southward. By the time the forests of the valley were depleted, Canadian lumbermen had discovered that they could set a foot of lumber down in London via the Champlain Canal for less than one-half that of the St. Lawrence route. Consequently, the canal was flooded with Canadian timber.

Not only was the transportation of agricultural produce cheapened, but also the cost of every article of manufacture required by the producer. In some instances the returns on meat and grain increased fifty percent.

It was the coming of the railroads into the Champlain Valley that crippled the canal. The Delaware and Hudson Railroad cut slowly but steadily into the boating business. The career of the packets was soon closed. Although the freight lines continued to operate, they fought a losing battle. Throughout the years of active competition, the canal interests did not fail to respond to the railroad threat. A deeper and wider channel, improved and enlarged locks and the abolition of tolls was the cry of the canalers. But because of the petty jealousies of Western New York, who feared that a ship canal would ruin the Erie Canal route, and the fact that any appropriation in the legislature must run the gauntlet of the railroad men, few improvements resulted. The failure to enlarge the Champlain Canal led to the subsequent suspension of the proposed St. Lawrence-Lake Champlain Ship Canal. As a result of these actions the state was surrendered to the railroads.

THE PROBLEM OF EXCHANGE EQUILIBRIUM  
AND WORLD TRADE EXPANSION

(Publication No. 2551)\*

Francisco Ramon Saenz, Ph.D.  
Columbia University, 1951

Between 1819 and 1914, the central position occupied by Great Britain in the field of production, trade, and finance, provided the conditions in which the gold standard could work reasonably well. Its position as a leading creditor nation was counterbalanced by a large excess of imports over exports of merchandise, and by considerable foreign investments, which effectively supplied other countries with an elastic medium of exchange in the form of gold and pound sterling that varied directly with the volume of world trade.

During the First World War, the United States became the leading creditor, and the central position in world trade and finance formerly occupied by Great Britain was transferred to this country. The international position of the United States was different from that of Great Britain. Its balance of trade was constantly favorable, and gold movements were mainly inward. The problem of exchange stability became acute after the First World War, because the United States did not organize a functioning international monetary system corresponding to its central position in world trade and credit.

The point of view emphasized in this work is that no substantial contribution will be made toward the solution of the problem of exchange stability, until some way has been found to eliminate the lack of balance between the economy of the United States and that of the rest of the world, other than by gifts and grants-in-aid. This is a problem of unravelling and correcting the influences in international trade and finance, which have compelled world-wide suspension of gold convertibility, and made necessary government regulations and restrictions on trade and exchange. The present dollar shortage cannot be corrected exclusively through measures acting on the foreign balance, such as import restrictions, or exchange controls. The long-range objective should be to attack directly the problems of trade and finance — to reduce or remove entirely the need for such controls, by measures which promote the recovery and expansion of international trade, and which help to maintain it at a high volume. It is first necessary to organize a workable system of multilateral trade and payments, before exchange rates can be established on a more permanent basis.

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The solution to the problem of exchange stability proposed in this work is designed to set in motion, policies which will promote the recovery of international trade. Because the Monetary Fund has at present complete jurisdiction over exchange rates and related policies, the solution proposed consists in an Amendment to its Articles of Agreement. The essence of this Amendment is to enable nations which are members of the Fund to buy additional imports from one another, under a long-term multilateral clearing agreement, by using reciprocal credits based on the total imports of each member from all other members, in a base year, expressed in a new international medium of exchange, which may be used to settle international balances. This new international medium of exchange may be used to buy increases in imports from any other member of the Fund, with the possible exception of countries having export trade balances. These countries have an option of remaining outside the agreement for not more than about six years, depending upon the size of their export balances of trade in relation to their imports in the base year. After about six years or less, countries can spend their remaining balances in any member country, including those with export balances of trade, which may have chosen to remain inactive during the first years, and after about fifteen years, the outstanding balances between international purchases and sales are to be repaid to the Fund over an approximate ten-year period.

The mechanism suggested differs from customary clearing arrangements in that it applies only to increases in trade over a base year; it deals with large sums of money; with many participants; and with a long period of time. It has the great advantage of operating under the administration of the Fund, subject to the provisions and safeguards contained in its Articles of Agreement.

**A FUNCTIONAL-HISTORICAL VIEW OF PLAINS INDIAN  
WARFARE: THE PROCESS OF CHANGE FROM THE 17th  
TO THE EARLY 19th CENTURY**

(Publication No. 2553)\*

Frank Raymond Secoy, Ph.D.  
Columbia University, 1951

In the early post contact period the introduction of the gun and the horse from opposite borders of the Plains area led to the development of two different patterns of military technique: the

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Post-horse-Pre-gun pattern and the Post-gun-Pre-horse pattern. The Post-horse-Pre-gun pattern developed in the southwestern plains. This pattern essentially consisted of a functionally related complex of material elements used in warfare. The warrior fought on horseback using the short bow, lance, and war club; he was protected by a leather shield and leather armor. His horse was also protected with leather armor, and was equipped with a bridle, a bit, and a high-pommeled, high-cantled saddle with stirrups. In addition, this pattern included the concept of the large-scale, pitched battle between two lines of cavalry. The Post-gun-Pre-horse pattern appeared in the northern Plains. In the eastern section of this area it appeared as a slight modification of the Eastern Woodlands pattern. The warrior was on foot and consistently armed with a gun. As secondary equipment he might carry a hatchet or a knife. Large formations were employed when necessary. On the Plains such forces were relatively compact, but deployed in an irregular manner, without line formation. In the western section of the northern Plains area this pattern took a somewhat different form. In the early phase, the Post-gun-Pre-horse pattern was largely blocked from expansion onto the Plains by the local trade situation which severely interfered with the flow of guns from the forest area onto the Plains. At a later period, after a good supply of guns had been made available to the Plains, a fusion took place between the Post-horse-Pre-gun pattern and the Post-gun-Pre-horse pattern. In the resultant Horse and Gun pattern, here on the Northwestern Plains, two alternative battle formations developed. The one was the cavalry battle characteristic of the Post-horse-Pre-gun pattern. The other was the battle of infantry lines. This form was probably developed by the interaction of two influences: the use of the gun on foot was likely derived from the Post-gun-Pre-horse pattern; the formation of the warriors into two, regular, opposing lines was probably derived, either directly or indirectly, from the old, Pre-horse-Pre-gun pattern of the Northwestern Plains.

The Post-horse-Pre-gun pattern developed first, and spread widely over the Plains. It was first diffused by the expansion of the Apache, its originators, over the Southern Plains. The Caddoans of the eastern margin of the Southern Plains adopted it in self-defense. It next spread to the Shoshone of the north, who then expanded explosively over much of the Northern Plains. The Post-gun-Pre-horse pattern became established on the northern Plains at a somewhat later date. In the early 18th century the two patterns met; along the upper Missouri River, in the Northeastern Plains, and along the Plains-Forest margin, in the Northwestern Plains. Here, a fusional form, the Horse and Gun military technique pattern was evolved, which spread west and south with the advancing Gun Frontier to cover the whole Plains. This last pattern is the one recorded by the 19th century sources as representing the "Classical" Plains culture.



The existence of opposing gradients in the concentration of horses and guns, running from the south and west to the north and east, was the fundamental factor which determined the course of development of the various military technique patterns. Thus, the advance of the northern and eastern margin of the horse gradient, the Horse Frontier, was practically coincident with the advance of the Post-horse-Pre-gun pattern. At a later date, when the Gun Frontier, moving in the opposite direction, had overlapped the Horse Frontier, the progress of the former marked the advance of the Horse and Gun military technique pattern.

THE FATE OF FRANKFORT ON THE MAIN:  
A STUDY OF POLITICAL DEVELOPMENTS  
LEADING TO THE END OF THE FREE CITY IN 1866

(Publication No. 2658)\*

Margaret Heiden Sterne, Ph.D.  
University of Michigan, 1951

The purpose of this study is to survey the circumstances that led to the Prussian annexation of the Free City of Frankfort in 1866. This seizure was of importance to the rising state of Germany.

After Bismarck's achievement of the Second Reich in 1871, most of his contemporaries were willing to place a stamp of approval upon all the steps which had carried him to success. But today there is an increasingly widespread conviction that Bismarck's Reich was founded on questionable principles. The annexation of Frankfort is a prominent example of the ruthless methods which Bismarck used to gain his ends.

Frankfort was the seat of the Diet and thus the capital of the German Confederation. Frankfort was also the focal point of the national movement for unification following the Napoleonic Wars. It experienced the Revolution of 1848-1849 in its full impact on the German nation. The process of democratization of the city government was in marked contrast to the development of the autocratic and military forces in the Prussian monarchy.

To explain the rising antagonism between Prussia and Frankfort, three major developments in their mutual relationship are examined here: the economic thrust of 1833 in which Frankfort tried in vain to break the Prussian Zollverein; the social threat of 1848 where the revolution in Frankfort culminated in the murder of two Prussian

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noblemen; and the political intrigue of 1865 when Frankfort contributed to the rupture in Austro-Prussian relations.

The consequence of these events was a Prussian vengeance upon the city when finally it came to hostilities over the Austro-Prussian struggle for supremacy in Germany. Frankfort was treated as conquered enemy territory, although there had been no declaration of war between Prussia and the Free City. In those civilized days, before the terror of "total war" had become an accepted reality, the treatment of Frankfort became an international scandal. The reactions of U.S. Consul General William W. Murphy in Frankfort have been considered in some detail. He witnessed the suffering of the city, he saw it lose its independence and become part of the Prussian monarchy.

It would appear that Bismarck deliberately chose to crush the city and through it the traditions for which it stood. Frankfort had been the election and coronation town of the Holy Roman Empire. Bismarck was determined to cut all ties which might form a bond with a universal Empire. In the Reich which he was about to shape, the gaze of the nation was to be averted from Frankfort and directed permanently towards Berlin.

Bismarck's Empire lasted less than fifty years, Hitler's Reich less than fifteen. Both these solutions of the German problem proved transitory because they were dictated by selfish and not truly national motives. The fate of Frankfort pointed up this spirit of aggression and injustice.

If a new solution for Mitteleuropa can be found on a basis of liberalism and freedom, Frankfort may again attain the place of importance which it held until the Prussians conquered it in 1866.

#### THE EVOLUTION OF CAVALRY IN THE AMERICAN CIVIL WAR; 1861-1863

(Publication No. 2661)\*

Thomas Frederick Thiele, Ph. D.  
University of Michigan, 1951

Despite the enormous number of volumes written about the Civil War, no complete or adequate study has been made of the role of Cavalry in that conflict. A comparative analysis of the numerical strength, armament, and remount system of the Federal and Confederate Cavalry has never been made, and generalities and partial

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studies have been accepted as representing the whole truth. In like manner, a complete review of the campaigns in the East and West with particular reference to Cavalry organization, leadership, tactics, and strategic uses has been lacking. This work, it is hoped, will fill these gaps.

Considerations of space have precluded covering the entire war in one volume, but the story has been carried up through 1863 which was the decisive year so far as Cavalry in the Civil War is concerned. The various aspects of the subject have been handled topically, and many of the conclusions reached on the various points under review are given at the end of each discussion. Some facets of the subject have been summarized because they have been treated adequately elsewhere, while other points have been expanded considerably because they have been neglected in other works on the Civil War.

The basic framework of the structure rests upon the reports and correspondence published in the Official Records. To fill the gaps left by the incomplete records, resort has been had to numerous diaries and memoirs as well as to other works written by participants in the Civil War.

A careful review of the facts has brought to light many points of interest. From the American Revolution to 1861, the United States Army and the people of this country displayed a conspicuous disinterest in the mounted arm of the service. Consequently, the Civil War found few, if any, commanders who understood Cavalry or its uses, and it was 1862 before the best of them displayed much talent in handling mounted troops.

Furthermore, contrary to popular opinion then and now, the Confederacy did not outnumber the Federal army in Cavalry except in the first few months of the war. The Federal army suffered from a lack of concentration of mounted force, rather than from a lack of mounted troops.

Considerations of uneven, timbered, and fenced terrain developed a system of Cavalry tactics which was unique in the military history of the Western world, for the Cavalry of both armies became very adept at both mounted and dismounted action.

Another new concept of Cavalry was embodied in the long strategic raid so common during the Civil War, but it was a less remarkable development than the new tactics, for the raid was not always successful or desirable.

Among these and other conclusions, it is obvious that the basic principles of organization, supply, employment, and command which were worked out so laboriously by the Cavalry of both armies in the Civil War may be applied to mobile troops in any army in any era.

THE DETECTION OF SYNGAMIN,  
AN INDIGENOUS PLANT HORMONE, BY THE "IN VITRO"  
CULTURE OF IMMATURE CORN EMBRYOS

(Publication No. 2688)\*

Stanley R. McLane, Jr., Ph. D.  
University of Missouri, 1951

Concurrent with syngamy (fertilization or gametic union) a systemic stimulation occurs in plants. Such a stimulation supposedly arises as a result of the action of "Syngamin," a hypothetical plant hormone(s). The present work deals with the extraction and testing of this substance(s).

A method for rapid excision and "in vitro" culture of immature corn embryos is described. Various fractions of immature corn kernel extract added to the embryo culture medium stimulated the growth of such embryos. The substance(s) responsible for this stimulation was termed syngamin as its activity is manifested following syngamy. Autoclaving water extracts of corn kernels destroyed or obscured the embryo growth promoting activity. Chemical determinations of the 3-indoleacetic acid content of the extracts and addition of that amount of chemically prepared 3-indoleacetic acid to a purely synthetic medium produced only inhibiting effects on the growth of immature corn embryos. No other concentration of 3-indoleacetic acid tested stimulated immature corn embryo growth. On testing extracts of corn harvested at various stages of maturity, the extract prepared from corn kernels harvested 5 days after pollination produced the greatest embryo growth. The growth promoting activity diminished from the 5 day post pollination to the 25 day post pollination samples.

Extracts of endosperm contained a greater quantity of syngamin than extracts of embryos. By various methods of extraction, syngamin was found to be insoluble in diethyl ether, petroleum ether, chloroform, and benzene. The growth promoting substance was found to be soluble in absolute ethyl alcohol, 95 percent ethyl alcohol, and water. Activated charcoal removed all traces of 3-indoleacetic acid and reduced somewhat the embryo growth promoting activity of the corn extracts. A scheme for partial purification of syngamin is described. Although autoclaving destroyed or obscured the activity of syngamin, a water corn extract could be boiled 15 minutes without reducing the apparent amount of the embryo growth promoting factor

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(syngamin). Syngamin was stable under basic conditions. Dialysis experiments showed that syngamin passed through a collodion membrane. Inositol did not aid embryo growth. Addition of 1.5 percent casein hydrolysate to the basal medium produced immature corn embryo growth equal to that of the fresh corn extract. Media containing 3 percent casein hydrolysate or a double portion of corn extract did not produce as much embryo growth as a combination of corn extract and 1.5 percent casein hydrolysate. Additions of 1 to 10 percent casein hydrolysate to the basal medium did not inhibit embryo germination. Germination was prevented by submerging the embryo below the surface of the medium or by addition of coumarin to the medium.

Plant embryo culture and the natural growth hormones involved in the sexual reproduction of plants are reviewed. A bibliography of 183 references is listed.

## LANGUAGE

### AN ENGLISH-LATIN-GREEK DERIVATIVE LEXICON

(Publication No. 2552)\*

Rudolf Franz Schaeffer, Ph. D.  
Columbia University, 1951

The topic of the Dissertation submitted herewith is An English - Latin - Greek - Derivative Lexicon.

The English words selected for the compilation of this word book are those of Latin and Greek origin found in:

(A) E. L. THORNDIKE and I. LORGE, The Teacher's Word Book of 30,000 Words, Part I,

(B) E. L. THORNDIKE, Teacher's Word Book of 20,000 Words, not already contained in (A).

The words are presented in two different ways; first, in an alphabetical English List giving for each word a frequency index, based on the one in the Teacher's Word Books, in most cases intermediary derivative steps within the Latin and Greek languages, so-called reference words, and Latin or Greek root words from which the English words have ultimately been derived; secondly, in two alphabetical lists of Latin and Greek root words, respectively. In these lists the English words are presented alphabetically under their respective root words in two columns according to their frequency index.

As a prerequisite step, in order to eliminate the English words of other than Latin and Greek origin, an etymological analysis of all

\* Microfilm copy of complete manuscript of 842 pages, \$10.53.

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words in the two Teacher's Word Books was carried out. Those words generally found to be of Greek or Latin origin on the authority of etymological dictionaries and etymological information in general dictionaries, Webster and Oxford English Dictionary in the first place, were subjected to further scrutiny involving the leading etymological word books of Latin, Greek, and French. A record was kept for each English word, and for the respective findings in each reference work consulted. This was done in especial detail for words where there was no general agreement regarding their linguistic source, and therefore independent decisions had to be made.

Words going back to two different languages (hybrids) were marked for both, the Latin and Greek lists, if both roots were found to be of classical origin. The language origin of a non-classical root was marked accordingly.

Words under whose outward appearance two (or more) words of different meaning and origin are hidden (homographs) were included if the homograph as derived from Latin or Greek had a sufficiently high frequency of occurrence according to I. LORGE and E. L. THORNDIKE, Semantic Count of English Words.

It is the presentation which distinguishes this project from general and etymological dictionaries as well as from specific word study books and special sections in general textbooks. The English vocabulary of the Teacher's Word Books evaluated in the Lexicon is selected for its usefulness in our schools. It is the vocabulary of general education, required for making and understanding of utterances on a cultural level, reaching far into the general terminology of the arts and sciences, the very vocabulary in which Latin and Greek play a predominant part.

The practical application of this Lexicon is not limited to the English and Latin classroom. Foreigners studying English as a second language, particularly those with a background knowledge of a Romance language or of Latin, should find this Lexicon a practical reference book in which certain Latin and Greek roots with which they are already familiar through previous language experience, may serve as a key to give access to the meaning of a great many English words otherwise difficult to grasp. A similar service can be rendered to those on their way to acquire a professional or occupational vocabulary, largely drawn from Latin and Greek, in the sciences and related fields.

There are a great many Greek and Latin-derived words whose form and meaning have changed before or after reaching the English language in different periods and under varied cultural and political impacts, and this to such an extent that their ultimate connection with an ancient root is of little value for ordinary word study. These very words in their arrangement under their respective ultimate sources may serve as illustrative material for classes in Linguistics and

"General Language" concerned with the growth and development of the English Vocabulary.

Sufficient space is available in the Latin and Greek Lists for selection and adaptation of the English derivatives to meet individual needs.

With the Latin and Greek element as a constant potential source future revisions of the Lexicon are envisaged to cope with the ever changing and shifting vocabulary of a living language.

## LINGUISTICS

### A STUDY OF SOME ASPECTS OF A JUDEO-SPANISH DIALECT AS SPOKEN BY A NEW YORK SEPHARDIC FAMILY

(Publication No. 2602)\*

Ruth Hirsch, Ph. D.  
University of Michigan, 1951

The purpose of this study is to present a description of a Judeo-Spanish dialect of two speakers; the data are limited to a tape recording of an hour and a half. This study of Judeo-Spanish differs from previous ones in its synchronic approach and in the application of modern descriptive methods to the body of materials. It does not assume present-day standard Spanish as the basis for analysis, a practice common to the majority of previous attempts to describe the dialect. However, some of the problems could not be solved by the descriptive method alone. Then the comparative method was employed, but only after a satisfactory description of the recorded corpus had been made.

The Chapter on Sounds presents two separate phonemic analyses, one for each speaker. The informants are of two generations, a mother in her seventies and a daughter in her forties. Coexistent phonemic systems or fragments of coexistent systems were found by applying phonological, morphological and cultural criteria, and unassimilated loans were established. Charts of phonemes separating the Judeo-Spanish system from others are presented at the end of the chapter.

In the Chapter on Forms only one description is given as the two speakers show only few differences on this level. Here too fragments of coexistent systems were found. However, these fragments

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were less extensive than those in the previous chapter. A sample of the data on which this analysis is based is included.

The Chapter on the Lexicon deals with those words, taken from the recorded corpus, which are of historical or dialectal significance. The words are compared with parallel occurrences in older Spanish dialects and/or with present-day peninsular Spanish dialects and dialects in Spanish America. Some of the words discussed in this chapter have been identified as assimilated or unassimilated loans from Arabic, English, French, Hebrew, Italian, Portugese, and Turkish. In addition to written sources, the writer of this dissertation has used a Turkish student at the University of Michigan as an auxiliary informant in identifying some of the words from the above languages. For the remaining lexical items, for which no parallels could be found in the languages and dialects mentioned, hypotheses as to their etymology were ventured whenever possible.

A list of abbreviations is included in Appendix I. Appendix II, the Bibliography, consists of two parts: A. General Bibliography — a listing of all works used in the preparation of this dissertation except those listed under B. B. Critical Bibliography — all available works on the Judeo-Spanish language and literature, with a short evaluation following each entry.

For the purpose of a phonemic study, the size of the recorded corpus has in general proved satisfactory. Some deficiencies were discovered, but only of relatively minor importance. However, for the description of verb forms, an insufficient amount of data was obtained in the recorded corpus which yielded an unsatisfactory analysis. Therefore additional material had to be secured so as to be able to deal with verb forms adequately. Only one item of lexical significance was found in the additional material.

## LITERATURE

### HAWTHORNE: A STUDY OF HIS LITERARY DEVELOPMENT

(Publication No. 2519)\*

Richard Perrill Adams, Ph.D.  
Columbia University, 1951

Hawthorne, in his best works, had essentially a single theme and a single symbolic structure for its effective communication. Like

\* Microfilm copy of complete manuscript of 354 pages, \$4.43.

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many romantics he was chiefly interested in personal development, which he described most effectively as the metaphorical death and rebirth of his protagonists. His own literary development consisted in an ever-broadening interpretation of this theme and the evolution of more various images and a clearer structural pattern to express it.

His earliest fiction was unsatisfactory, but in the Provincial Tales (1828-29?) he used comparatively simple patterns of death and rebirth and images of heat and coldness, roughly and somewhat ambiguously corresponding to good and evil, to describe his protagonists' progress from adolescence toward maturity. These protagonists die in the sense that, through experience of evil, they are made to abandon childish innocence, after which they may either achieve rebirth in adult awareness of both good and evil or, as in "Young Goodman Brown," remain in a state of moral uncertainty and isolation.

For the next twelve years, Hawthorne tried to please the public rather than himself, and succeeded in pleasing neither very well. But he learned to use images of wandering and buried treasure to represent confusion and frustration, and images involving mirrors and fountains to represent introspection and inspiration. In 1842 he invented an allegory of the heart as a cavern which embodied the structural principle of symbolic death and rebirth in a three-part form: outer sunshine (youth, naivety), inner gloom and terror (experience of evil), innermost light (perfection of character). In "Rappaccini's Daughter" (1844) he used this form to organize all six classes of his imagery and to communicate most effectively Giovanni Guasconti's tragic failure to be reborn in the innermost region of perfection, which is like Young Goodman Brown's failure to reach maturity.

In "Ethan Brand" (1848) Hawthorne tried to abandon his usual theme and structure in a realistic novel about the degeneration of character, but he was unable to finish it. He returned in The Scarlet Letter (1849-50) to the theme of individual development and carried it as far as he could, using the form of the cavern allegory and all six classes of his imagery. Dimmesdale, the protagonist, through his experience of evil and suffering, achieves, if not perfection, a considerable enlargement of his character. Hawthorne extended his theme in The House of the Seven Gables (1850-51) to describe the development of a family, but the happy ending he provided is structurally inconsistent and therefore weak. He tried in The Blithedale Romance (1851-52) to present the character of contemporary society in a realistic way, with even less satisfactory results. In these books his imagination seems not to have kept up with the progressive enlargement of his theme.

In The Ancestral Footstep (1858) he attempted a fictional handling of his experience in England. He abandoned it, unfinished, to write The Marble Faun (1858-60), using the structure of the cavern allegory consistently to describe the development of the human race

from almost bestial simplicity to nineteenth century civilization. Although he somewhat overindulged his interest in Italian art and scenery, Hawthorne carried his theme farther and gave it more scope here than in any other work. From 1860 to his death in 1864 he tried in three MSS to write a novel on the closely related themes of an English inheritance and earthly immortality. His failure to finish it was caused, not by illness or senility, but, like previous failures, by the fact that he had departed from the theme and symbolic structure of his best works.

### THE THEORICA PLANETARUM OF CAMPANUS OF NOVARA

(Publication No. 2522)\*

Francis Seymour Benjamin, Jr., Ph. D.  
Columbia University, 1951

The main subject of this dissertation is an introduction to and annotated text of the hitherto unpublished Theorica planetarum of Campanus of Novara, a thirteenth century Italian mathematician and astronomer. This work was one of the principal astronomical texts used in the universities in the fourteenth and fifteenth centuries. The introduction is preceded by a short title and sigla index. Then follows the first chapter on what facts concerning the life of Campanus can be ascertained, succeeded by chapters concerning a general synopsis of the contents of the Theorica, other works by or ascribed to Campanus, two chapters on those works and men in the same field which influenced or were followed by this author and those which made use of this particular work, and a concluding chapter on the manuscripts on which the text is based. This part of the dissertation ends with a series of appendices dealing with minor points of detail such as a list of all the manuscripts of this work extant, other such manuscript lists of works of Campanus or those directly dependent upon the Theorica and two appendices devoted to the manuscripts and incipits cited in the introduction. The second part of the dissertation is the annotated text with two sets of notes, one of variant readings, the other of relevant material to the text drawn from other works. Concluding are three appendices to the text too extensive to be included in the notes, the third appendix being a series of tables broken up into their component parts.

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\* Microfilm copy of complete manuscript of 477 pages, \$5.96. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-265.

DANTE'S DIVINE COMEDY IN ENGLISH  
AND AMERICAN CRITICISM SINCE 1910

(Publication No. 2494)\*

Evangeline Grace Bollinger, Ph. D.

University of Michigan, 1951

The twofold purpose of this study is to estimate the contribution of contemporary critics to the appreciation of Dante's poetry and to bring into clearer focus the specific connections in which they have made use of Dante in their speculations on literary problems.

The organization is topical. Chapter I is concerned with comments of such critics as Herbert Read, T. S. Eliot, R. P. Warren, Allen Tate, Mark Van Doren, Dorothy Sayers, and Charles Williams on the Divine Comedy in relation to the question of "pure poetry," or, more specifically, of whether "poetry" can be isolated in elements, aspects, or parts of poems; Chapter II with various attempts to define the distinction between philosophy proper and philosophical poetry and to single out peculiar problems besetting the philosophical poet; Chapter III with the controversial implications of labeling Dante a "Thomist poet;" Chapter IV with the relationship of allegory and symbolism and the present status of allegory as a genre; Chapter V with Dante's distinctive method of creating allegorical characters who function as natural symbols; Chapter VI with the function of imagery in the total scheme of the poem; Chapter VII with the perennial question of the relevance of shared belief in the enjoyment of poetry.

With regard to recent literary critics' contribution to the appreciation of Dante's poetry, the study indicates that although the treatment of Dante by literary critics, as distinguished from Dante specialists, has frequently consisted of little more than undeveloped hints, these critics have nevertheless suggested directions along which a sound, perceptive analysis of the Divine Comedy might proceed. Further, within the last decade, the work of such critics as Charles Williams and Dorothy Sayers illuminates by detailed analysis several of the encomiastic generalizations made earlier by T. S. Eliot and others regarding Dante's poetic method. However, the cumulative effect of the emphasis which a large number of influential modern critics have placed on the poem as an essentially aesthetic structure and on Dante as a poet of contemporary relevance is perhaps more significant than the original insights which individual critics have offered.

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\* Microfilm copy of complete manuscript of 205 pages, \$2.56.  
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The study bears out the assertion that the wide-spread interest in Dante is related to general critical preoccupations. Critics have found the Divine Comedy particularly adaptable in their opposition both to the notion of "pure poetry" and to the equating of poetry with the short lyric form. Their concern with the poet's method of realizing a pattern of theological concepts through skillful apportioning of imagery and characterization in an allegorical narrative is a logical corollary of their protest against evaluation of poetry on the basis of the merit of the ideas expressed as well as against the assumption that ideas are impurities in poetry. Their conclusions concerning Dante's didacticism are closely related to the discussion of the "intentional fallacy." Further, with such critics as Charles Williams and Northrop Frye, the reading of Dante has been seminal in the formulation of theories of literary interpretation.

#### RUSKIN'S DEFENSE OF TURNER

(Publication No. 2577)\*

Van Akin Burd, Ph. D.  
University of Michigan, 1951

This study analyzes the principles upon which John Ruskin defended the art of the painter, J. M. W. Turner. His argument, Ruskin stated repeatedly, was based on the premise that the painter imitates nature. What did Ruskin mean by nature? How did he use it in his study of Turner's pictures which he often described as the painter's impressions? What were the stages of development of the critical point of view by which he studied Turner?

The first section considers the background of ideas dominating the periodical reviewers who charged during the 1830's and 1840's that Turner's pictures were out of nature. The study shows that these reviewers represented an extension of a decadent critical tradition claiming Sir Joshua Reynolds as its authority. Although Reynolds' intention had been to teach a generalized concept of form, his followers apparently concluded from his lectures that his theory of the ideal was to be equated with the attitudes of such seventeenth century painters as Claude and Rosa. The ideal accordingly became associated with the picturesque conventions of the older painters' treatment of form. This concept of the ideal seems to have been the nature which the critics missed in Turner's later work.

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\* Microfilm copy of complete manuscript of 439 pages, \$5.49.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-320.



The second section of this study traces the development of Ruskin's defense of the painter from his first essay on Turner in 1836 through the last volume of *Modern Painters* in 1860. The first stage of Ruskin's interest in the painter represented the imitative phase of his development. Brought up in the atmosphere of loyalties to the eighteenth century, Ruskin quite naturally defended Turner on the basis of the ideal as he had learned it in Reynolds. Ruskin's gradual emancipation from traditional attitudes marked the second stage. His unpublished diary of 1842 contains new evidence that he was moving beyond the limits of the picturesque world of the painters into a wider range of beauty. The first volume of *Modern Painters*, however, failed to develop an adequate theory of perception that would allow Ruskin to interpret Turner's treatment of nature. What was obviously purpose in Turner's work was not explained by the mechanical psychology which Ruskin had borrowed from Locke.

Through Ruskin's unpublished letters to his parents in 1845, this study follows Ruskin's insight on the psychology of imagination described in the second volume of *Modern Painters*. Although influenced by many writers, Ruskin demonstrated in himself a remarkable sensitivity to that quality of imagination by which Turner had conceived form. Such problems as nature, perception, and imagination in Turner's work he now approached with the modern concept of mind as the force which shapes the materials of thought into unified experience. Praising Turner's pictures as the artist's impressions, Ruskin, in the final phase of his development, saw Turner as a great artist whose pictures embodied his intuitive understanding of experience.

Ruskin's achievement was therefore twofold: he broke the spell of the picturesque which had dominated the art critics of his time, and he brought to the criticism of art an essentially modern psychology of the creative process.

#### THE CRITICAL VALUES OF WILLIAM CRARY BROWNELL

(Publication No. 2592)\*

Frank Fletcher, Ph.D.

University of Michigan, 1951

Although William Crary Brownell (1851-1928), drawn into and generally associated with the New Humanist dispute, was condemned and defended with animus during the period of that dispute, there has been no clear statement of his essential "values" as a critic. Analysis of him by other critics ends in evasion and ambiguity. This study

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\* Microfilm copy of complete manuscript of 488 pages, \$6.10. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-335.

attempts to determine those essential values with special reference to his essays in literary criticism. It falls into three parts. The first examines his values generally as they are revealed in the volumes treating mainly of conduct and society. The second considers the values evident in his writings most clearly concerned with aesthetics and the relationship of these "aesthetic" values to his values generally. The last considers the application of these values as they emerge in his essays in literary criticism. The study ends with an estimate of Brownell.

In all of Brownell's writings there is an ambiguity ascribable to his ill-defined use of large abstractions. Of these, however, six terms or ideas prove to be more significant than others in Brownell's thinking — "reality" or "truth" (one idea), "culture," "style," "reason," "personality," and a studio term, "ensemble." In both his early praise of the ensemble that he finds characteristic of French society and in his later flaying of the egotism and independence he sees in conduct in the United States, Brownell reveals that he is thinking in terms of the psychology, the sociology, and the metaphysics of value rather than of actual values. The specific values he seeks — and here is the source of ambiguity — remain implicit in such focal abstractions as have been mentioned, which are used to indicate normative qualities self-evident to the cultured man. Brownell commits himself early to a concept of value as absolute, objective, culturally developed, dependent upon a "religious" view of the universe, and in its realization characterized by what he calls "tension." Value in conduct and art demands conformity; its origin is "culture," its embodiment "personality," and its monitors "reason" and "truth," tact, measure, and discipline.

An analysis of his "aesthetic" beliefs, treated in part two, reveals that Brownell ultimately identifies style, "the art of art," with the moral "ensemble." Style, or ensemble in art, is ultimately the product of the artist's personal, imaginative, "cultured" view; it achieves truth and reality; it is the product and evidence of "personality." Under analysis, the personality that Brownell prefers proves to be that which has such character qualities as are suggested by the indefinables "elevation," "gentility," "ideality," "the inner life." "Personality" becomes at once the most focal and the most evasive of Brownell's values.

Consequently, Brownell's literary criticisms, relying upon so evasive a pattern of value, even though occasionally they prove incisive and stimulating, prove on the whole ineffective. Relying mainly on the undefined criteria of "reality" and "personality" in his criticism of prose fiction, Brownell's values reduce to the "humanity," the "vision," the "feeling," the "ideality," of such a personality as Thackeray. His criteria of "culture" and "reason" in his criticism of non-fiction writers reduce to the "sweet reasonableness" of Arnold.

In each case the actual values remain the subjective, indefinable aesthetico-moral ones in the cultivated sensitivity of the conservative Victorian gentleman.

### CONTROVERSY IN SOVIET LITERARY CRITICISM ON THE DOCTRINE OF SOCIALIST REALISM

(Publication No. 2535)\*

Kenneth Eugene Harper, Ph.D.  
Columbia University, 1950

In 1934, the "basic method" of all Soviet literature was declared to be "Socialist Realism." In succeeding years, a considerable amount of controversy developed among Soviet literary critics with respect to the precise meaning of this rather broad term. The present study traces the ensuing controversy as it is reflected in journalistic articles, books, and speeches in the period from 1932 to the present. Specifically, this study is concerned with the arguments aroused by the following questions: the relation of artistic method to world view, Socialist Romanticism, the Positive Hero, and "Formalism."

The first of these questions involved the interpretation of realism in Soviet literature. A large number of literary critics, following a remark of Engels, maintained that world view was not the primary requisite of the Soviet writer striving for realism; these critics held that the development of realistic method should precede the study of ideology. The opposing view was that the writer must first of all acquire the viewpoint of Soviet Marxism, and that without this ideological background the correct interpretation of current reality was impossible. The predominance of ideological doctrine was officially established in the latter part of the 1930's.

Socialist Romanticism, under the sponsorship of Maxim Gorky, attained great currency in literary criticism in the 1930's, as a kind of complement to Socialist Realism. Eschewing the traditional "idealism" of Western romanticism in literature, the Soviet critics maintained that literature should possess an inspirational quality and the ability to "look to the future," to lead from the present to the imagined, but necessary, life of "communist, classless society." The latter point proved especially controversial. Many critics declared that, in practice, the depiction in literature of a more desirable future indicated the writer's dissatisfaction with the less desirable present. Such a writer, and the critics who supported him, disbelieved in the

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value of the reality of socialism, it was charged. The opposing view was that some kind of "vision" of the future was necessary to true realism.

The element of dissatisfaction with the present also formed a basic theme in the heated discussions of the Positive Hero — the literary character who was to represent the ideal Soviet citizen. Numerous critics in the mid-thirties objected to the new heroes of literature, saying that they were too narrow, too restricted by the conditions of the present struggle, and too virtuous to be typical; a hero of broader sympathies and of a more rounded personality was urged. The opposition argued that the model of future man was to be found in the Party-man type of hero, and that this character type was actually typical in current Soviet life. The disputes on questions of literary form reveal a growing distrust of innovation in technique and an increasing tendency, officially inspired, to identify interest in matters of form with "bourgeois formalism."

The present study shows the existence of a considerable amount of controversy in Soviet literary criticism, the limited areas of controversy, and the effect of social and political events upon public debate. It indicates that in times of crisis literary criticism becomes standardized, and that it tends to accept the status quo. It also indicates that Soviet literary criticism is more and more characterized by what may be called "idealism," i.e., the tendency to enthrone that which "ought to be" as the only true reality.

#### THE LYRIC POETRY OF ANDREW MARVELL

(Publication No. 2538)\*

Lawrence William Hyman, Ph.D.  
Columbia University, 1951

This work has as its main purpose a reinterpretation of Marvell's poetry in the light of the new knowledge that has been gained about the seventeenth-century world view. It makes use of Cassirer's conception of the mythic mind and Whitehead's conception of the world to show a connection between the natural objects in the poems and human feelings, ideas, and values. Secondly, all the lyric poems are brought together in a pattern which has as its two poles action and contemplation. Thirdly, an attempt is made to evaluate the poems by relating their intellectual and emotional complexity to their poetic excellence.

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Since he looked at the world as a living organism, in much the same way as did Plato in the Timaeus, Marvell did not make our modern sharp distinction between fact and value. Natural facts, such as grass, flowers, fruits, straight lines and circles, were endowed with specific human values. Therefore, when we come upon such images in the poems we must recognize that they are not merely decorative, nor are they farfetched or "witty." On the contrary, they express very directly the poet's attitude towards love, sexuality, innocence, sin and death. For example, Damon the Mower discusses a lover cutting the grass. But since grass represented the flesh, or carnal desires, Marvell is not only describing a pastoral scene, but discussing sexuality, sin, and (since the grass is cut down) death. Similarly, a knowledge of the significance to Marvell of motion, rest, circles, straight lines, as well as flowers and trees, or permits us to reinterpret even such well known poems as To His Coy Mistress and The Garden.

Action, for Marvell, implied an acceptance of all aspects of life without any regard to morality. Contemplation implied a withdrawal from most human activities, since these activities were always immoral. In the love poetry this is seen in the conflict between sexual desire and an equally strong tendency to continence. In the political poems action takes the form of supporting Cromwell's government, even when it violated Marvell's conception of justice; and contemplation takes the form of supporting the retired General Fairfax.

The third aspect of this work, the evaluation, is based on the belief that the excellence of a poem is not the result of a special faculty of "wit," but is the result of the depth and honesty of a poet's thoughts and feelings. When Marvell reaches a simple solution, by ignoring the demands of body, the result is a poor poem such as the Dialogue between the Resolv'd Soul and Created Pleasure. When, on the other hand, he has the honesty to admit the strength of both body and soul (or sexuality and innocence) and the intellectual ability to reconcile them, we have such poems as To His Coy Mistress, The Coronet, and The Garden.

## ENGLISH PROSE FICTION, 1600-1642: A SURVEY

(Publication No. 2500)\*

Charles Carroll Mish, Ph.D.  
University of Pennsylvania, 1951

In the history of English prose fiction the years 1600-1642 cannot be thought of as constituting a definite and self-sufficient period. Much of the fiction of these decades is anonymous, a large number of titles are translations from French or Spanish, and those authors who have signed their work are likely to be otherwise undistinguished persons with but a single title of fiction to their credit. Though it is possible to establish the traits of a standard Caroline tale as distinct from one typically Elizabethan, it would seem hardly profitable to attempt to set up an Early Stuart period of fiction; at neither end would a genuine line be permissible, for development rather than innovation is the characteristic of the fiction of the time. The limiting dates of this study, which attempts a synoptic survey of all fiction printed (not merely written) within its inclusive dates, are then conveniences only, serving merely to block out a period which has had little or no detailed examination.

Though the most striking fact in seventeenth-century fiction is its two-fold division into romantic and realistic which it inherits from Elizabethan and medieval fiction, a good deal of variety exists among the some 160 titles forming the basis of the material available to the reader. We may distinguish, first of all, two kinds of romance: the continuation of the old chivalric type and a newer variety which models itself on Sidney's *Arcadia* and, with its interest in love and manners rather than mere knightly exploits, mediates between the chivalric romance and the later heroic romance. At least three kinds of tales exist: the sentimental, the moral, and the merry. We find also a body of jestbook material, running from collections of detached anecdotes to continuous stories; a group of picaresque writings, with which are allied a few efforts in bourgeois realism; some Arcadian fiction, more or less closely tied to Sidney's work; and a miscellaneous scattering of imaginary voyages, Utopian fiction, satire, and collections of bizarre or unusual occurrences.

The progress of fiction across the four decades of the period is halting and spasmodic, but, if there is no steady course of development, and if progress is all too often apparently negated by regression to what seems today a cruder model, it is still possible to find some

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change between the beginning and the end of the period. This change lies in the direction of a more realistic setting and more probable action, together with better handled motivations, all conveyed through the medium of a more informal, rapid, and natural prose. At its best fiction remained tinged with preciousness, but there was a gradual yielding to the demands of common sense in both technique and language.

**GARIN LE LOHERANT, ACCORDING TO MANUSCRIPT N:  
BIBLIOTHEQUE DE L'ARSENAL 3143 (FORMERLY 181)  
TEXT PUBLISHED FOR THE FIRST TIME,  
WITH AN INTRODUCTION**

(Publication No. 2547)\*

Richard Gladwin Monges, Ph. D.  
Columbia University, 1951

The work comprises the transcription of the complete text of "Garin le Loherant" according to manuscript N of the Bibliothèque de l'Arsenal (ms. 3143, formerly 181), preceded by an introduction and followed by three appendices, two tables of proper names, a short glossary and bibliography. The 13,660 lines of this version of the "Garin" have not previously been published in their entirety.

Chapter I is a general introduction, which gives an outline of the larger project of which the present work is an integral part: a complete edition of the entire cycle of the "Geste des Lorrains," for which the Bern manuscript, ms. B, has been selected as the basic manuscript. This chapter reviews previous works involving ms. N, which differs from all other known manuscripts of the Lorraine cycle in that it contains all four branches of the geste. This chapter also outlines the relationship of ms. N to ms. I and ms. T.

Chapter II endeavors to show the principal differences between the versions of "Garin" in ms. N and the basic ms. B, dividing them into: (1) differences in episodes which are common to ms. N and ms. B, and (2) the principal episodes of ms. N not contained in ms. B; finally, (3) those episodes related by B but not by N. These various differences are then discussed.

Chapter III discusses proper names which occur in ms. N but not in ms. B, and those which are different in corresponding lines of the two manuscripts. One section deals with names of persons, another with place names. An attempt is made to identify names

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peculiar to ms. N with historical persons or recognized geographical sites, or with similar names in other mediaeval French poems.

Chapter IV considers the phonology, morphology, syntax and versification of the text of ms. N, limiting such consideration of the first of these subjects to variations from the Francian or 12th century French which is the basic language of the manuscript.

Chapter V leads to conclusions which are subject to eventual revision upon termination of the complete studies of the entire "Geste des Lorrains" referred to in the paragraph above which deals with Chapter I, which studies are to take into consideration all known manuscripts of the cycle, and correlated on manuscript B. Meanwhile, certain dialectal peculiarities and historical allusions in manuscript N indicate that the version of "Garin" which it presents originated in the region between Valenciennes and Tournai; the manuscript itself probably dates from the latter part of the 13th century.

Appendix I is a Table of Correspondences of the lines of N with those of B; it serves as a guide in comparing the text of N with the version of B.

Appendix II gives the folio and line numbers of ms. B.

Appendix III presents a transcription of the text of the versions of the Life of Saint Amant and the founding of the monastery of Elnon, made from the related manuscripts I and T, for comparison with the version of ms. N.

The Table of Proper Names includes all names of persons and places and the numbers of the lines of N in which they occur.

A short glossary, limited to words of uncertain or unusual meaning or peculiar spelling concludes the work.

#### AN EXPLANATION OF THE FORMS OF THREE SERIOUS SPANISH BAROQUE DRAMAS ACCORDING TO WÖLFFLIN'S PRINCIPLES OF ART HISTORY

(Publication No. 2645)\*

Darnell Higgins Roaten, Ph.D.  
University of Michigan, 1951

This is a study of the problem of elucidating the forms of three serious Spanish Baroque dramas, using the categories developed in Heinrich Wölfflin's Principles of Art History. Only three plays were studied because the Baroque theater of Spain constitutes a close-knit

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school of esthetic thought and practice. This monograph does not consider the Renaissance forms as contrasted with those of the Baroque, as Wölfflin does in the work mentioned above, but rather is restricted to an examination of the Baroque only.

Wölfflin's five categories concerning the plastic, spatial arts of the Baroque are as follows: 1. Painterly. 2. Recession. 3. Open form. 4. Absolute unity. 5. Relative clearness (or lack of clarity). These five categories are translated into terms appropriate to the temporal art of the drama as distinct from the spatial arts of painting, sculpture and architecture. The principal part of the study is devoted to a consideration of the formal relationships of the various elements of plot in Lope's Fuenteovejuna, Calderón's La vida es sueño and Guillén de Castro's Las mocedades del Cid. This analysis discusses Wölfflin's five categories as applied to the aforementioned plays by considering in detail what interrelations exist between the parts within each single play. These elements include the following:

1. The mutual interconnections of the chief plot and the sub-plots.
2. The connections between scenes.
3. The manner in which incidents are made to fit together to form a single plot.
4. The relationship to the plot of such decorative passages as descriptions and speeches not strictly necessary to the development of the plot.
5. The mutual relationships of the characters.
6. The relation of differing emotional tones within a single scene or in different scenes.

Specific parallels with the plastic arts are suggested in order to make clear the usefulness of Wölfflin's categories in explaining the forms of the Baroque theater.

The conclusions are as follows:

1. Wölfflin's principles are useful in explaining the forms of the three plays analyzed.
2. It may be inferred that these principles could serve to explain the forms of other serious Baroque plays.
3. This investigation offers evidence which suggests that other arts of this period may be amenable to the same kind of formal analysis.
4. Baroque is not necessarily a decadent form of art but is merely different from other periods.
5. Baroque art is not hopelessly obscure. It can be understood in the light of its own esthetic principles.

MIDDLE ENGLISH DIDACTIC VERSE  
AN EDITION OF REPRESENTATIVE POEMS

(Publication No. 2646)\*

Thomas Wynne Ross, Ph. D.  
University of Michigan, 1951

This dissertation is an edition of sixty-five poems in Middle English, varying in date from about 1250 to 1525. The poems have been selected to represent dominant types of didactic verse, both secular and religious. These types are divided into two major categories: first, verse which is intended to inform or edify; second, verse which admonishes the reader, or audience, as well.

None of these poems has hitherto been edited. They were selected from manuscripts preserved on microfilm at the University of Michigan General Library, and from photostats obtained from British and American libraries. When the poems occur in more than one version, parallel texts have been reproduced. The edition is accompanied by a complete critical apparatus: explanatory notes, textual notes, glossary, and descriptions of the manuscripts used.

In the Introduction, the editor traces the origins of Middle English didactic verse. In 1281, official ecclesiastical sanction was given to the use of the vernacular for the purpose of religious instruction. In the fourteenth century, the Church sponsored the use of rhyme for the education of its parishioners. The growing ascendancy of secular interests at the end of the fourteenth century, and throughout the fifteenth century, gave rise to new species of didactic verse. These compositions dealt with secular matters: with man's relationship to his physical surroundings and to his own society. They were intended for secular audiences, and their authors were often laymen. There is evidence, however, that the parish priest was sometimes the versifier responsible for poems dealing with worldly matters. The development of Middle English didactic verse therefore reflects the eventual emergence of the newly-literate layman. Although his interests differed from those of his clerical predecessors and contemporaries, he nevertheless adopted the traditional formulas and techniques which had been approved by the Church itself.

The dissertation thus serves two purposes. First, it makes available, for the first time, approximately 3200 lines of Middle English verse. Second, it classifies this poetry according to a scheme which represents the development of the religious and secular thought of the medieval Englishman.

\* Microfilm copy of complete manuscript of 540 pages, \$6.75.

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## BURKE'S POLITICS AND THE LAW OF NATURE

(Publication No. 2656)\*

Peter James Stanlis, Ph.D.  
University of Michigan, 1951

The chief purpose of this thesis is to describe the vital position of the classical Law of Nature in Burke's political theory, and to show how the Law of Nature is the ultimate moral basis of Burke's conception of sovereignty and civil liberty, of constitutional law, of his principle of prudence, and his theory of human nature and Church and State. Burke's normative conception of "Nature" is clearly and consciously related to the rich tradition of the Law of Nature which includes Aristotle, Cicero, Justinian, Bracton, St. Thomas Aquinas, Hooker, Coke, Suarez, Grotius, Locke and Blackstone. In applying his political theory, Burke constantly appealed to the Law of Nature as the ultimate ethical norm by which he judged men's ideas, actions, laws, manners and institutions, as the means for preserving and extending man's highest social end — civil liberty.

During the last decade of the eighteenth century, Burke's Reflections on the Revolution in France became the focal point in the vital controversy concerning "Nature" and "natural rights," and in the course of this ideological conflict Burke revealed the essential principles of his political theory. The rich array of evidence from Burke's speeches, correspondence and works proves conclusively that throughout his entire career, in the practical affairs of India, the American Colonies, home rule, Ireland and France, Burke always appealed to the classical Law of Nature.

Nevertheless, the consensus of scholarly opinion for the past hundred and fifty years has been that Burke's political philosophy is founded in a conservative Utilitarianism. This serious misinterpretation resulted from three things: (1) the assumption that in attacking "metaphysical abstract rights" Burke rejected the Law of Nature; (2) the failure of scholars to consider Burke's important appeals to the law of nations; (3) the Utilitarian interpretation of Burke's principle of prudence, which was considered antithetical to the Law of Nature.

From the many replies to Burke's Reflections, however, it is clear that when his opponents appealed to "Nature" and "natural rights" they meant by it something very different from the classical Law of Nature assumed by Burke. The distinction between Burke

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and his opponents is most clearly expressed in the antithesis between "nature" and "art," or between "natural society" and artificial or civil society. Burke rejected Utilitarianism, yet never made the "natural" and artificial antithetical; his theory of human nature and of the origins, structure and function of Church and State, is centered wholly in the classical Law of Nature.

It is unfortunate that Burke's writings have been so neglected in the twentieth century, because no political thinker has more to say on the eternal problem of maintaining civil liberty against tyrants who violate the moral Law of Nature.

FRANCIS THOMPSON'S PHILOSOPHICAL POETRY:  
AN EVALUATION

(Publication No. 2666)\*

Catharine Carolin Weaver, Ph. D.  
University of Michigan, 1951

This study of Francis Thompson's poetry is divided into two parts: the first is a discussion of the philosophical material of the poetry in relation to Thompson's life and generation: the second contains analyses of a number of individual poems, analyses which reveal Thompson's success in embodying that philosophy in terms that have not only the intellectual but also the imaginative and emotional values proper to poetry.

Because Thompson's life and thinking are frequently regarded as set apart from that of other men, particularly those of his own generation, his poems are often thought to be "beyond the reach of the normal man." Examination of his ideas in their historical context disproves this notion. Thompson accepted traditional Catholic thought, not because he was immune from doubt and temptation, not because he was ignorant of contemporary controversies, not because he was assured of its truth in a mystical vision, but because he was intellectually satisfied by the answers Catholicism offered to the questions he and his generation asked.

He was no more isolated as a literary man than as a thinker. A member of the Catholic Literary Revival he made a conscious attempt to express his faith in poetry; at the same time he accepted many of the literary principles that the Romantics preached, not the least among them the principle of organic unity. His ultimate purpose was not didactic but aesthetic, the expression of total experience, emotional, imaginative, sensuous as well as intellectual.

\* Microfilm copy of complete manuscript of 189 pages, \$2.36.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A51-407.



The analyses contained in the second part of the study test the success with which Thompson put his literary theories into practice. Poems like "A Narrow Vessel," "A Judgment in Heaven," and "Daisy" illustrate the difficulty he had in finding symbols that would convey his full meaning. But in the "Orient Ode" and "Assumpta Maria" he found ways to share his meaning, particularly with his Catholic readers; in those poems above all he turned for images to Catholic tradition and liturgy. In poems like "The Hound of Heaven" and "To a Snowflake" and "The Kingdom of God" he found means to reach a wider audience. His skill in weaving abstract and concrete, idea and emotion, his handling of rhythms, his choice of images mark these as his best.

Judged on aesthetic grounds Thompson is an important minor poet, the author not only of "The Hound of Heaven" but of some dozen other very good poems. These poems are valuable not only for Catholics who welcome poetry that expresses their faith but for any reader who may want to know "what it feels like to believe" as Thompson does, who wants to share the poet's experience as a man as well as a thinker, who, in short, applies aesthetic as well as philosophic tests to the poems.

#### AN EDITION OF SOME MIDDLE ENGLISH AMATORY LYRIC POEMS

(Publication No. 2668)\*

Kenneth George Wilson, Ph.D.  
University of Michigan, 1951

This is an edition of forty-three late Middle English love lyrics, forty-two of which have never before been printed. All but one of the poems are extant in unique MS versions; one exists in three different MSS, and all three texts are included in this edition. In addition to the texts of the poems, together with textual and explanatory notes, there are descriptions of the MSS, a glossary, an index of names and places, and an introduction.

In the introduction, the editor attempts to describe the conventional aspects of the fifteenth-century love lyric as these are exemplified in the matter and form of the poems in the edition. It is the editor's contention that these descriptions of the conventions will form hypotheses and working definitions for the examination and description of all fifteenth-century English love lyrics.

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\* Microfilm copy of complete manuscript of 509 pages, \$6.36.  
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Card Number Mic A51-409.

The typical fifteenth-century love lyric is a poetic epistle or address by the lover to his lady, in which the lover complains of his pains, begs for grace, and vows lifelong service. In addition to this conventional lyric letter, there are also several conventional elements of matter appearing in poems which in other respects vary from the traditional lyric. These include (1) the lament on absence or separation, (2) the lover's farewell, (3) the address to other lovers, (4) the lover's vow, and (5) the description of the lady. These conventional elements are occasionally used in combination with other, older, traditional medieval literary devices, such as allegory, debate, and dream vision. The editor suggests that there is an appreciable change in the method and content of many of these lyrics which indicates the continuous development of the writing of English secular lyrics from Chaucer to Wyatt.

Two conclusions develop in the description of the prosody of these poems: (1) half the poems employ rime royal rime schemes, while the other half show extreme diversity and complexity in rime schemes; (2) stressed verse predominates where there is adherence to any rhythmical or metrical pattern, but it seems fairly certain that these poets paid almost no heed to rhythm and meter.

THE SPACE OF INESSENTIAL CONTINUOUS  
FUNCTIONS INTO THE CIRCLE

(Publication No. 2588)\*

Bertram J. Eisenstadt, Ph.D.  
University of Michigan, 1951

The space of continuous functions from a compact space  $X$  to the real line has many natural algebraic and topological properties. Two problems of fundamental interest have been:

- 1) to obtain necessary and sufficient conditions that a given algebraic, topological structure be equivalent to such a function space, (the characterization problem) and,
- 2) to discover if the function space considered as a given structure determines the topological properties of the space  $X$ .

Characterizations as a lattice ring, a normed algebra, a normed lattice, and a Banach space (normed vector space) have been given by Stone, Gelfand, Kakutani, Myers, Arens and Kelly, and others. In addition Stone, Myers, Kaplansky, Millgram and others have shown that the topological properties of  $X$  are determined by many different structures on the function space.

More recently Jerison showed that the real line could be replaced as the image space by certain Banach spaces and the resultant Banach space of functions would still determine the topological properties of  $X$ . A characterization as the space of functions into such Banach spaces was also given.

In this paper we consider the preceding problems with the circle replacing the real line as the image space. The space of inessential continuous functions from a space  $X$  to the circle (the component of the identity in the space of all continuous functions) is a metric abelian group. We show that the metric group properties of this function space determine the topological properties of  $X$  for  $X$  a compact space and we obtain necessary and sufficient conditions that a metric abelian group be equivalent to such a space of functions for  $X$  some compact, connected space.

That the function space determines the topological properties of  $X$  follows quickly from the similar theorem for Banach spaces. To obtain the characterization, conditions were put on the group which ensured the existence of a pseudo multiplication by real scalars on the group. A pseudolinear functional (character) from the group to the circle was then defined and conditions were given to

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\* Microfilm copy of complete manuscript of 54 pages, \$1.00.  
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ensure the existence of sufficiently many characters. The elements of the group correspond to inessential functions from the space of characters to the circle. In general, there are too many characters, and the group elements do not give all the inessential functions on this space. The space  $X$  is, in general, a subset of the set of all characters. This subset is obtained by investigating certain Banach spaces associated with the group. The usual methods for finding the points of  $X$ , the  $F_T$ 's of Myers and the extreme points of Aren's and Kelly do not give the required results here and certain new functionals are defined. A new characterization of a space of functions into the real line is given in terms of these functionals and from this characterization a metric group characterization of the space of inessential functions from a compact, connected space  $X$  to the circle is obtained.

#### THE ADAPTABILITY OF COLLEGE MATHEMATICS COURSES TO STUDENTS OF CERTAIN DESCRIBED CHARACTERISTICS

(Publication No. 2676)\*

Carl Valentine Fronabarger, Ph.D.  
University of Missouri, 1951

Major Adviser: Ralph K. Watkins

##### Purpose:

To determine the adaptability of certain college mathematics courses to students characterized on the basis of number of units and kind of mathematics studied in high school, size of high school from which they graduated, high school rank, command of fundamental mathematical skills and processes, mental ability (treating separately quantitative and linguistic aspects as well as total ability), and success in prerequisite courses.

##### Method of Research:

A comparison was made of students of differing characteristics, as described above, in terms of marks attained in college mathematics courses. By implication, courses are considered reasonably well adapted to students of the described characteristics when students are able to make satisfactory marks and not well adapted when they make unsatisfactory marks.

Adaptation of a college remedial mathematics course to students of relatively low mental ability was determined by the effect of

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the course upon improved arithmetic proficiency, as measured by the Stanford Achievement Test.

#### Summary:

1. The findings of this study should be useful in determining the adaptability of college mathematics courses to students in other institutions, in so far as they have the characteristics of the students in this study.

2. Courses whose content is largely arithmetic can be made significant and useful to college students of relatively low mental ability.

3. Courses such as Analytic Geometry and Calculus are best adapted to students of high quantitative ability and accomplishment who have had at least three units of high school mathematics.

4. The procedures used in this study can be used by other colleges to determine the adaptability of courses to their students.

5. When college students having one unit of high school general mathematics are matched, pairwise, with students having one unit of high school algebra and equivalent G-Scores on the ACE psychological Examination, there is no significant difference between the two groups in regard to command of fundamental mathematical skills and processes or success in the courses, Arithmetic for Teachers and Intermediate Algebra. The same is true when those having the two units, general mathematics and algebra, are compared with those having algebra and plane geometry.

6. Students taking the courses Analytic Geometry and Calculus are highly selected with respect to quantitative ability and accomplishment, but marks in these courses are more closely related to success in prerequisite courses than to differences in ability as measured by the ACE Psychological Examination.

#### Recommendations:

1. A college remedial course in mathematics can profitably be offered to students of low arithmetic achievement. The course should be required of students making below 70 on the Stanford Achievement Test, Advanced Arithmetic.

2. College mathematics courses having the greatest functional value to students entering professions not requiring specific mathematical training should be introduced. Content of such courses should be based on recent investigations.

3. Students expecting to enter professions requiring a major or minor in college mathematics should have at least three units of high school mathematics. These units should include algebra and geometry, and may include a course in general mathematics.

4. For high school students taking only two units of mathematics and not expecting to enter professions requiring specific college mathematical training, the general mathematics and algebra

combination is just as satisfactory and perhaps more satisfactory than the algebra and plane geometry combination.

5. A remedial course in mathematics for high school seniors of low arithmetic achievement is desirable. It could be given during one half of the senior year and would benefit more students than a college remedial course.

# CHARACTERIZATIONS OF CONTINUOUS FUNCTION BANACH SPACES

(Publication No. 2600)\*

Lester J. Heider, Ph.D.  
University of Michigan, 1951

The space  $C(X)$  of all real valued continuous functions on a bi-compact Hausdorff space  $X$  is a Banach space. The question arose of what Banach spaces  $B$  are equivalent to a  $C(X)$  for some  $X$ . After a preliminary effort of Eilenberg the question was answered by Clarkson, Myers, Arens and Kelley. In this paper a correlation of these results with one another and with the earlier Krein and Kakutani studies of linear normed lattices leads to simplified characterizations, a completion of the effort of Eilenberg, and new results on associated problems.

Clarkson introduced a partial ordering on spaces  $B$  satisfying certain conditions under which ordering these spaces satisfied the Kakutani characterization of  $C(X)$  as a linear normed lattice. This suggested the principle that a space  $B$  is equivalent to a  $C(X)$  if and only if it is susceptible of a partial ordering under which it is both equivalent and lattice isomorphic to a  $C(X)$ . Replacing the involved Kakutani characterization by the simpler results of the Kreins', this principle yields an extremely simple Banach space characterization of  $C(X)$ . After comparing these results with those of Clarkson, the Kreins and Kakutani, the same methods are used to obtain a Banach space characterization of the abstract  $(L)$  spaces of Kakutani in terms of the  $T$ -sets of Myers.

These results imply that a space  $B$  is equivalent to a  $C(X)$  if and only if there exists a subset  $Q^* \subset B^*$  bicomact in the weak-\* topology of  $B^*$  such that  $B$  is equivalent to  $C(Q^*)$  under the map  $b \leftrightarrow b(b^*)$ ,  $b^*$  variable in  $Q^*$ . Since Myers had worked independently to this same result through the development of his  $F_T$  functionals, we next note that the methods of Myers, precisely as they touch

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this characterization problem, can be paralleled closely without predevelopment of the  $F_T$  functionals and then, to show possible applications of this elimination, we characterize spaces  $B$  which are isomorphic to a  $C(X)$ .

The extreme points of space  $B^*$  adjoint to  $B$  were used by Arens and Kelley to solve the characterization problem. The discussion of these points employs the representation of  $C^*$  adjoint to  $C(X)$  as a space of regular Borel measures. This motivates our development of a simplified proof of the Borel measure representation of  $C^*$  and a new application of this representation to the discussion of extreme points.

Eilenberg had introduced a quasi-closure operation on certain maximal convex sets and showed that for space  $C(X)$  the result was a bicomcompact Hausdorff space homeomorphic to  $X$ . Replacing the Eilenberg sets by  $T$ -sets and using a geometrical picture together with a new definition of the quasi-closure operation, the interesting properties of this operation are presented, a characterization of  $B$  equivalent to a  $C(X)$  is given, metric properties of  $B$  are linked with topological properties of  $X$ , and a new aspect of ascending sequences of adjoint spaces is developed.

#### STATISTICAL RANK AND SAMPLING VARIATION OF THE RESULTS OF FACTORIZATION OF COVARIANCE MATRICES

(Publication No. 2644)\*

Dayle Donald Rippe, Ph. D.  
University of Michigan, 1951

Not enough attention has been given to the sampling variability of the underlying covariance matrix nor to the linearity assumption in many articles written about factor analysis or in articles in which the techniques of factor analysis are used. In this study both of these aspects are stressed, and considerable work is done on a mathematical discussion particularly of the sampling problem.

The method of maximum likelihood is used to derive a criterion to "measure" the sampling variation possible in large sampling for the underlying sample covariance matrix. This criterion is then applied to test the completeness of the matrix factorization of the covariance matrix and yields a large sample test for significance of common components. The criterion depends very directly on the sample size, on the order of the covariance matrix, and of course,

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on the size of the residuals in the residual covariance matrix. The criterion is perfectly general in the sense that it may be applied to any method of orthogonal matrix factorization in which a  $k \times k$  covariance matrix may be reproduced to rounding errors by  $k$  components.

The generality of the development leading to the basic criterion also yields tests of conventional correlation coefficients the results of which check very closely with known exact sampling results. Due to the assumption of large sampling, the results are not valid in cases in which only a small sample is available. However, the results are surprisingly accurate even for relatively small samples. In some cases, the basic criterion yields a test which is applicable where exact sampling tests are not valid.

Finally, the sampling variability that may be present in the underlying covariance matrix is used to study the variability that may be expected in the resulting component loadings. The initial results are given in terms of orthogonal components, but the method is generalized to provide results appropriate also for oblique components.

Illustrative examples are included for all of the theory developed, and the computational techniques involved are discussed.

# ESSENTIALLY COMPLETE CLASSES OF DECISION FUNCTIONS FOR CERTAIN STANDARD SEQUENTIAL AND NON-SEQUENTIAL PROBLEMS

(Publication No. 2556)\*

Milton Sobel, Ph.D.  
Columbia University, 1951

The thesis starts with an outline of some of the basic ideas of a general decision theory given by Wald in his book "Statistical Decision Functions." For example the concept of the risk function and the concept of an essentially complete class of decision rules are defined and illustrated.

The aim of the paper is to show with the aid of Wald's results on the class of all Bayes solutions that in certain standard sequential and non-sequential problems there is a relatively small and simply described class of decision rules which form an essentially complete class with respect to the class of all decision rules that have a bounded risk function. In short if the value of a decision rule

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is based solely on its risk function then we can disregard any decision rule which is not in the essentially complete class.

The first problem considered is concerned with a binomial chance variable  $Y$  such that  $P\{Y=1\} = p$  and  $P\{Y=0\} = 1-p$ . It is desired to test sequentially the hypothesis  $H_1: p \leq p'$  against the alternative  $H_2: p > p'$  where  $p'$  is a given constant such that  $0 < p' < 1$ . There is given an indifference zone in the form of an open interval  $(P_1, P_2)$  containing  $p'$ . If a simple weight function and a simple cost function are assumed then it is shown that the following class  $C$  of decision rules is an essentially complete class for the above problem. The class  $C$  of decision rules  $\delta$  is defined by asserting that a decision rule  $\delta \in C$  if and only if

1) for each  $n$  the rule  $\delta$  depends only on the number  $d_n$  of ones obtained in the first  $n$  observations and

2) for each  $n$  there is a closed interval (or a finite set of successive integers) say  $J_n: [a_n(\delta), b_n(\delta)]$  such that the following hold.

a) As long as  $a_n(\delta) < d_n < b_n(\delta)$  then the rule  $\delta$  is to take another observation and as soon as  $d_n \notin J_n$  the rule  $\delta$  is to stop experimentation.

b) At the time of stopping if  $d_n < a_n(\delta)$  then  $H_1$  is accepted and if  $d_n > b_n(\delta)$  then  $H_1$  is rejected ( $H_2$  is accepted).

c) If  $a_n(\delta) < b_n(\delta)$  then  $H_2$  cannot be accepted when  $d_n = a_n(\delta)$  and  $H_1$  cannot be accepted when  $d_n = b_n(\delta)$ .

The second problem is concerned with a normally distributed random variable with known variance ( $\sigma^2 = 1$ ) and unknown mean  $\Theta$ . The hypothesis  $H_1: \Theta \leq \Theta'$  is tested sequentially against the alternative  $H_2: \Theta > \Theta'$  where  $\Theta'$  is a given constant. As in the previous problem an indifference zone is given in the form of an open interval  $(\Theta_1, \Theta_2)$  containing  $\Theta'$ . If a simple weight function and a simple cost function are assumed then a relatively small class  $C'$  is exhibited which is an essentially complete class for this problem. The class  $C'$  is defined just like  $C$  above except that  $d_n$  is replaced by the mean  $\bar{X}_n$  of the first  $n$  observations. Condition 2 (c) can be omitted since it only affects a set of measure zero on which the decision rule need not be defined.

The third problem is a non-sequential problem with  $k$  mutually exclusive and exhaustive hypotheses. A chance variable with the probability distribution

$$p(y, \Theta) = e^{q(\Theta) + r(\Theta)h(y) + t(y)}$$

is considered. This distribution includes the normal, the binomial, the poisson and other distributions of special interest. The problem is to select one of the  $k$  hypotheses

$$H_1: \Theta \leq \Theta_1; H_2: \Theta_1 < \Theta \leq \Theta_2; \dots; H_k: \Theta > \Theta_{k-1}$$

where  $\Theta_1 < \Theta_2 < \dots < \Theta_{k-1}$  are given finite constants. A set of  $k-1$

disjoint open intervals  $Z_i$  are given such that  $\Theta_i \in Z_i$  and  $Z_i$  is an indifference zone with respect to  $H_i$  and  $H_{i+1}$  ( $i = 1, 2, \dots, k-1$ ). If a simple weight function and a simple cost function are assumed then a relatively small class  $C''$  is exhibited which is essentially com-

plete for this problem. To define  $C''$  let  $v = \sum_{i=1}^n h(x_i)$ . The decision

rule  $\delta \in C''$  if and only if  $\delta$  defines a set of  $k-1$  ordered constants -  $\infty \leq c_1(\delta) \leq \dots \leq c_{k-1}(\delta) \leq \infty$  which characterize  $\delta$  as follows:

"If  $-\infty < c_1(\delta)$  then accept  $H_1$  when  $-\infty < v < c_1(\delta)$ .

If  $c_1(\delta) < c_2(\delta)$  then accept  $H_2$  when  $c_1(\delta) < v < c_2(\delta)$ .

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If  $c_{k-1}(\delta) < \infty$  then accept  $H_k$  when  $c_{k-1}(\delta) < v < \infty$ .

If  $v = c_{i_1}(\delta) = c_{i_2}(\delta) = \dots = c_{i_p}(\delta)$  then  $\delta$  can select any hypothesis  $H_j$  with  $i_1 \leq j \leq i_p + 1$  using any fixed randomized procedure."

Finally a two sided non-sequential problem is considered with the same probability distribution as in the previous problem. A relatively small essentially complete class of decision rules is found for testing

$$H_1 : |\Theta| \leq \Theta' \quad \text{against} \quad H_2 : |\Theta| > \Theta'$$

where  $\Theta'$  is a given non-negative constant.

A secondary aim of this paper is to characterize the class of all Bayes solutions and an important subset thereof in each of the last two problems.

## MUSIC

### THE MOTETS OF ORAZIO BENEVOLI

(Publication No. 2576)\*

John Rennie Bryden, Ph.D.  
University of Michigan, 1951

The purpose of the study, The Motets of Orazio Benevoli, has been to bring to light for re-examination a specific contribution to music by this Roman composer. Benevoli was born in Rome in 1605; he died there in 1672. The neglect shown by most musical historians to his motets in comparison with his Masses has motivated

\* Microfilm copy of complete manuscript of 578 pages, \$7.23.  
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the writer in this research. Biographical information on the composer and a historical view of the period has been included as an aid in the understanding of his musical style. Perforce, a consideration of his motets must also include information of the conditions and manner of performance of these compositions.

An attempt has been made to compile a complete list of Benevoli's works. This list, based on known catalogues and additional information received directly from Rome, contains a total of 243 titles. Seventy-four of the 171 known motets have been received on microfilm from European and American libraries. The present study is based on sixty-nine complete motets which were transcribed into present-day notation.

This study of the motets is presented in two volumes. Volume I, the text, comprises material pertinent to the man and his work: biographical and historical remarks, a stylistic analysis, appendices, etc. Volume II reproduces forty-six representative motets in a scholarly edition. The study makes more readily accessible certain information on an idiom of sacred music overshadowed by the secular music of the period; it also sets forth an improved catalogue with indication of the present location of the works of the composer. Sacred works which deserved consideration are made available in the second volume for comparison with other compositions of similar medium and possible performance.

Benevoli lived and created in a period of transition. His known works are all based on sacred texts. Many of his motets were written for few voices in an idiom quite different from the so-called "colossal" style of his many Masses. He showed tendencies of archaism, yet he was progressive and cognizant of the monodic style prevailing in his time. He was a man of his age.

## PHILOSOPHY

### THE AESTHETIC THEORY OF I. A. RICHARDS

(Publication No. 2574)\*

Manuel Bilsky, Ph.D.  
University of Michigan, 1951

This is a study of the aesthetics of I. A. Richards. The problem of the study contains two parts. The first is to put together the main doctrines concerning aesthetics which are to be found in Richards' published works. The second is to criticize the consistency and value of the doctrines.

The problems of aesthetics may be classified under three heads: the ontological and psychological status of the art object, the work's function as a vehicle of communication, the work as an object of a value judgment. Accordingly, Richards' remarks on each one of these have been examined in detail. But since Richards' unique status among aestheticians is due to his insistence on the application of psychology to aesthetics, this detailed examination has been preceded by an exposition of his psychological principles. Each of these four sections has an expository part and a critical part. In the expository part an attempt is made, on the basis of Richards' published works, to reproduce faithfully what he says. In the critical part an attempt is made to estimate the consistency of the correlative expository part. The concluding chapter discusses the consistency of the theory as a whole and points out Richards' distinct contribution to both aesthetics proper and practical criticism.

The results indicate some inadequacies in the four areas treated. Richards' claims for psychology in aesthetics are too extravagant. His analysis of the art object is exhaustive, but his identification of the work of art with a set of experiences generates some difficulties. Richards' theory of communication suffers similarly, mainly in his treatment of metaphor and belief. His value theory is marred by a lack of precision: he uses "good" in three different ways. But the most serious difficulty here lies in his assumption that he has a quantitative theory, whereas in reality a qualitative aspect surreptitiously plays a part in his analysis and prevents his having a completely psychological theory.

Concerning the aesthetic theory as a whole there are three main aspects in which Richards' views are inadequate. The first concerns his definition of a work of art as a class of experiences of which the artist's, as he contemplates his completed product, is

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the standard. This definition is incompatible with his theory of communication. Secondly, his discussions of belief are confused by his failure to realize the proper status of what he calls the general type of belief. Finally, Richards constantly vacillates between being a philosophical analyst and attempting to support some particular theory.

Richards' unique contribution to aesthetics stems from his preoccupation with the analysis of meanings. In practical criticism he has given the critic some valuable tools for analysis, interpretation, and evaluation. He has also given the critic an autonomy rarely enjoyed previously. Largely as a result of Richards' efforts, he need no longer be a theologian, a historian, a moralist, or a biographer in addition to being a critic. He may restrict his activities to the analysis of the structure of the art object and to the judgment of its value.

#### MATTER AND STRUCTURE

(Publication No. 2529)\*

Alastair Nicol Craig, Ph.D.  
Columbia University, 1951

The problem of matter is essentially a problem of structure, the problem of accounting for permanence amidst change, stability amidst process. It is not enough to construe natural existence in terms of mere process; for the basic problem of the stability, endurance, persistence and continuity of the physical world must be accounted for within a philosophy of process. Matter must not be identified with natural existence as a whole; for natural existence includes stability and change, structure and process. We must narrow down the definition of matter to account only for the stable structures in the physical world and not for the whole dynamic field of natural experience.

What I have emphasized in this dissertation is: 1) that matter be understood as the ontological principle, a stubborn factor in our experience which does not derive from experience but is prior to and independent of experience; 2) that matter be defined in terms of processes and dynamisms and not in terms of a static substratum; 3) that matter be identified not with process, but as the stable, persistent, enduring component of process and finally; 4) that matter be defined as the structure of physical processes.

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Thus I shall give the name "matter" to the stable component in the realm of natural existence. Consequently matter is dynamic insofar as it participates in process and stable insofar as it is the structural component of that process. If matter (as I define it) does not seem dynamic in comparison with the frenetic rush of experience, it is because matter comprises a stable structure which has a rate of change different from that of experience. Matter is relatively permanent in comparison to the experiential flux, but this permanence is a property of the internal organization of the physical processes which comprise natural existence and not of an absolute principle. The apparent inertness and changelessness of matter is expressed as the structure of physical processes, a stable organization of the dynamisms which comprise process. Actuality is shot thru with potentiality — the actuality expressing the stability of existence and potentiality expressing the dynamism of existence.

Matter is no "mystic inner core" and its properties are not just epistemological entities. For matter must be understood in terms of an ontological principle which gives significance to experience and meaning to existence. As a countercontrol to our experience and as a brute fact, matter is not a mere unknowable thing-in-itself; it is the root of all experience and the primordial source of all sense-data.

VARIETIES OF PLATONISM IN CONTEMPORARY  
RELIGIOUS THOUGHT; WITH SPECIAL REFERENCE TO  
W. R. INGE, P. E. MORE, A. E. TAYLOR, WILLIAM TEMPLE,  
A. N. WHITEHEAD, AND GEORGE SANTAYANA

(Publication No. 2533)\*

William Davidson Geoghegan, Ph.D.  
Columbia University, 1951

The purpose of this dissertation is to exhibit and critically evaluate some of the major varieties of Platonism in contemporary religious thought. While each of the thinkers has been treated in his distinctiveness, three major patterns have been found. Inge and More attempt the maximum assimilation of Platonism with Christianity. For Inge, Platonism culminates in the thought of Plotinus, regarded as a mystical metaphysic of value, which he combines with liberal Christianity. More finds the essence of Platonism in Plato's moral dualism, which achieved religious significance in the Patristic

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formulation of the doctrine of the Incarnation. It is found that both have an uncritical conception of the Platonic tradition, Inge's being amorphous while More's is overly schematic. Furthermore, Inge is insufficiently appreciative of the historical elements of Christianity, while More fails to appreciate the rational method and content of Christian thought. While Inge's cosmocentric Idealism and absolutistic Theism and More's humanism and finite Theism reflect significant differences within the Platonic tradition, neither of them does full justice to Christian Platonism, nor do they make it relevant to the outstanding problems of contemporary religious thought.

Taylor and Temple are more critical than Inge and More in their attempts to assimilate Platonic with Christian thought, and they are more at home in the contemporary scene. Although the authority of Taylor's Platonic scholarship is generally recognized, he frequently confuses the critical and historical exposition of Platonism with the didactic exposition of Christian thought. Taylor's constructive religious thought, marked by elaborate erudition as well as dialectical skill is, however, more of an apology for Christian Platonism than a creative advancement of it. Temple's historical exposition of Platonism is negligible because it is highly derivative. Although, like Taylor's, his constructive thought is marked by some grave ambiguities, it is superior in that it offers an original contribution to the solution of some pressing contemporary problems. Taylor and Temple properly recognize that Platonism and Christianity can be integrated on the basis of ethical Theism.

In their basically naturalistic thought, Whitehead and Santayana are not concerned with reconciling Platonism and Christianity, although they do adopt some revised Platonic notions. Whitehead's provocative discussions of Plato's thought can scarcely be regarded as reliable historical exposition. His conception of Christianity is largely a reflection of contemporary Anglo-Saxon Liberalism. However, his constructive religious thought is more applicable to some outstanding problems than any other which we have considered; but only in a nominal sense is it Platonic. Santayana's conception of Platonism is critically significant because of the centrality it gives to the crucial problem of the Ideas. He so conceives Christianity that it can scarcely be relevant today, in its historical forms, except as poetry. While his constructive religious thought is original and comprehensive, he fails to reconcile its materialistic and idealistic elements. Although the problem is not central with either, both Whitehead and Santayana show that Platonism and Christianity may be reconciled on the basis of their moral idealism.

It is concluded that, despite many profound differences, Platonism and Christianity share ethical Theism and moral idealism in their historical traditions, and that it is in these respects that they are relevant to the problems of contemporary religious thought. It

is also concluded that the Christian faith is not presented in its full intellectual vigor in the thought of the Christian Platonists whom we have studied, and that Plato's dialogues will be a primary source of philosophical stimulation long after his contemporary interpreters have passed into obscurity.

## PHYSICS

## THE USE OF REAL GASES IN A SHOCK TUBE

(Publication No. 2585)\*

Russell Earl Duff, Ph.D.  
University of Michigan, 1951

The advantages and disadvantages of using various gases in the compression and expansion chambers of a shock tube are considered in this investigation. In particular, the changes in the basic shock tube equations caused by 1) temperature dependence of the specific heat, 2) deviations from the ideal gas equation of state, and 3) vibrational relaxation are treated. In addition, the effects produced by the use of various gases on the applicability of a shock tube as an instrument for hydrodynamic investigation are considered.

It is shown that the strongest shock wave for a given initial pressure ratio across the diaphragm can be produced by using hydrogen in the compression chamber. However, it is necessary to eliminate oxygen from the expansion chamber in order to prevent an explosion, which could be initiated by the conditions behind the reflected shock wave.

Expressions for the flow velocity produced by a rarefaction wave in an ideal gas with temperature-dependent specific heat and in a van der Waals' gas with constant specific heat are developed. Numerical calculations for hydrogen show that these deviations from ideal behavior are unimportant.

Shock wave equations analogous to the Rankine-Hugoniot equations are developed for an ideal gas with temperature-dependent specific heat. Numerical calculation shows that, for a given shock velocity, the temperature behind the shock wave is lower than predicted by the Rankine-Hugoniot equations, while the pressure, density, and flow Mach number are higher.

Relaxation phenomena are investigated insofar as they influence the flow through shock waves. The time dependence of the flow parameters in the transition region behind weak shock waves, where

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thermal equilibrium is being established between the various degrees of molecular freedom, is calculated using the results of earlier work by Bethe and Teller.

Experiments are described in which the velocity of a shock wave reflected normally from a surface is determined as a function of time. This velocity is found to be variable in carbon dioxide, while it is constant in nitrogen, argon, and sulfur hexafluoride. One can therefore conclude that vibrational relaxation influences only slightly the flow in carbon dioxide in a shock tube.

In the investigation of the relative duration of uniform flow, the assumption is made that the rate of development of a stationary flow is proportional to the speed of sound behind a shock wave. The duration index, which can be used to compare the flow durations in different gases, is then defined. It is shown that, for a given Mach number, the relative duration of uniform flow is virtually independent of the gas used in the expansion chamber. Experiments are described which verify these predictions.

Finally, the additional effects of a large number of physical and chemical properties of gases are discussed. The conclusion is reached that hydrogen and nitrogen constitute the best combination of gases for general aeronautical research and that sulfur hexafluoride is one of the best gases for use in the expansion chamber in the investigation of fundamental hydrodynamic principles.

## ON THE THEORY OF FORBIDDEN BETA-TRANSITIONS

(Publication No. 2597)\*

Roland Hamilton Good, Jr., Ph.D.  
University of Michigan, 1951

In this thesis two problems which arise in Fermi's theory of beta-decay are discussed:

I. The validity of Fermi's treatment of the wave functions at the nucleus. In calculating the shape of beta-spectra, it is usually assumed that the wave functions of the emitted beta-particle are constant across the nucleus. However this assumption might be questioned, especially for certain forbidden spectra which are strongly dependent on the nuclear radius.

II. The effect of the screening of the atomic electron cloud on the shape of forbidden beta-spectra. In first approximation a beta-particle is emitted into an extra-nuclear potential which is just the

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Coulomb field of the daughter nucleus. A refinement is to take into account the influence of the field of the atomic electrons. The effect of the atomic electron screening on allowed spectra has been shown by several authors to be minor. This does not imply the same feature for the forbidden spectra because of the essentially different dependence on the nuclear radius.

After a summary of the basic beta-decay theory, the WKB approximation for the Dirac radial wave functions is developed, in order to discuss the problems above.

In discussing the first problem, a nuclear model with the electric charge distributed uniformly on the surface is considered and the values of the wave functions inside the nucleus are taken to be their values at the origin. The spectrum shapes predicted using this model are found to be practically the same as those found by Fermi's technique. This substantiates his way of calculating, both for the allowed and for the forbidden spectra.

In discussing the second problem, a Thomas-Fermi statistical potential is used for the residual atom. The screening effect is found to be of minor importance in forbidden as well as in allowed spectra.

## A STUDY OF THE ELECTRON LINE SPECTRA OF CERTAIN NEUTRON INDUCED RADIOACTIVITIES

(Publication No. 2612)\*

Harry Bert Keller, III, Ph.D.  
University of Michigan, 1951

The purpose of this study was to determine the gamma-ray spectra of the neutron induced activities in cerium and hafnium. In addition, the gamma-ray spectra of cerium 144, protactinium 233, europium 152, and erbium 171 were evaluated. In all cases, the gamma-ray energies were determined by the method of internal conversion.

The photographic method was chosen for its sensitivity, and the 180 degree focusing beta spectrometer for its ability to resolve weak lines or those close together. A vacuum gate was provided which enabled the source to be rapidly inserted into the camera chamber facilitating iterated bombardment and examination of the same sample. The permanent magnet employed could be altered by

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exciting coils to provide magnetic fields up to 1200 gauss, this made it possible to examine internal conversion electrons of energy up to 2.5 mev.

The activities, together with their properties as ascertained by these measurements, are listed below:

Protactinium 233: Decays by beta emission in 27.4 days to an excited state of uranium 233. Spectrograms indicate 14 gamma-rays which were satisfactorily accommodated in a decay scheme with 5 levels.

Europium 152: Decays by both beta emission and K-electron capture to excited states of gadolinium and samarium 152 in 9.2 hours. A single gamma-ray is involved in each decay process.

Erbium 171: Decays by beta emission in 7.5 hours to an excited state of thulium 171, which in turn beta emits to the ground state of ytterbium 171. The existence of 7 gamma-rays was established; they may be accommodated by a decay scheme of 4 levels.

Cerium 137: Decays by K-electron capture and the emission of a single gamma-ray in 36 hours to lanthanum 137.

Cerium 139: Decays by K-electron capture in 140 days to an excited state of lanthanum 139. The gamma-ray spectra consists of 2 components in cascade.

Cerium 141: Decays by beta emission to an excited state of praseodymium 141 in 28 days. The beta spectrum has two components; the one decays directly to the ground state, the other is followed by a single gamma-ray.

Cerium 143: Decays in 33 hours by beta emission to an excited state of praseodymium 143. Three gamma-rays were found which fit a two branch decay scheme. Praseodymium 143 is itself radioactive; it decays in 13.5 days by beta emission to the ground state of neodymium 143.

Cerium 144: Decays by beta emission in 300 days to an excited state of praseodymium 144. The proposed energy level scheme indicates multiple branching; 8 gamma-rays are accommodated in a 4 level scheme.

Praseodymium 144: Decays in 17.5 minutes by beta emission and a single gamma-ray to the ground state of neodymium 144.

Hafnium 175: A 70 day K electron capture process to an excited state of lutecium 175. The four gamma-rays found fit a three level decay scheme; the high energy crossover transition could not be found.

Hafnium 179: A 19 second isomeric decay of an excited state of hafnium 179. A single gamma-ray was found.

Hafnium 180: A 5.5 hour isomeric decay of an excited state of hafnium 180. Five gamma-rays were found, but no level scheme was indicated since no method of branching could be proposed.

Hafnium 181: Decays by beta emission in 46 days to an

excited state of tantalum 181. The gamma-ray spectrum consists of 5 components which readily fit in 3 levels.

# MOLECULAR SPECTROSCOPY WITH A HERTZIAN OSCILLATOR SOURCE OF MILLIMETER WAVES

(Publication No. 2629)\*

Arthur Hobart Nethercot, Jr., Ph.D.  
University of Michigan, 1951

A new type of Hertzian oscillator has been investigated as a source of continuous radiation suitable for molecular spectroscopy in the millimeter range of wavelengths. The source consisted of small charged spheres of mercury which fell freely towards a grounded mercury surface. When the separation between the spheres and the surface decreased to a critical value, a spark occurred, thus giving rise to damped electromagnetic oscillations.

In order to increase the energy output, fifty jets of mercury, each producing about one thousand drops per second were used; and these were placed along the axis of a section of waveguide, down a continuation of which the radiation travelled to a grating spectrometer. The radiation was detected either by means of a Golay Cell or a crystal (1N26). It was found that enough energy (greater than 0.1 microwatt) could be obtained to achieve resolving powers varying between 0.06 and 0.4  $\text{cm}^{-1}$  for wavelengths between 11 and 2.5 mm.

Spectra of the source were taken under various conditions. Different gratings were employed, both receivers were used, and different charging potentials were applied to the drops. An approximate theory has been developed for the source and the spectra observed are in general agreement with the exception of two important features. There was a minimum in the energy near 8.0 mm and also it had been anticipated that the source would be usable below 2.5 mm. It was found that an increased charging potential produced a larger proportion of short-wave radiation.

Two major modifications were made in the generator in an attempt to decrease the short-wave limit. A series of drop diameters was studied: larger drops produced slightly longer wavelengths, but with smaller drops the total energy emitted decreased too rapidly with decrease in diameter to allow examination of the spectrum. Furthermore, when the dimensions of the section of waveguide were made smaller, the decrease in the total energy far outweighed the

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favorable effects of any possible redistribution of energy in the spectrum. It may be concluded that although such a generator will operate reliably, stably, and consistently, it seems unlikely that modifications can make it a suitable source for radiation of wavelengths much shorter than 2.0 mm.

As a test of the generator in molecular spectroscopy, the absorption of ammonia was measured between 4 and 10 mm at pressures between 10 and 76 mm Hg. The results agree well with those of other investigators. Also the rotational spectrum of  $\text{CH}_3\text{Cl}$  between 4.4 and 2.6 mm ( $2.3\text{--}3.8\text{ cm}^{-1}$ ) was observed for the first time. The absorption of the  $J=2$  to  $J=3$  transition (which lies entirely within this range) was observed and the absorption of the  $J=3$  to  $J=4$  line could be followed to frequencies almost as high as the predicted resonance frequency of  $3.92\text{ cm}^{-1}$ . The absorption was measured at two pressures and agreed well with that expected.

## CONTRIBUTIONS TO THE THEORY OF CONDENSATION

(Publication No. 2641)\*

Robert James Riddell, Jr., Ph.D.  
University of Michigan, 1951

The problem of the condensation of a gas is intimately related to the asymptotic behavior of the virial coefficients,  $B_m$ , as  $m \rightarrow \infty$ . The subject of this dissertation is an attempt to determine this behavior, for the case of a gas in which the intermolecular forces are purely repulsive, as in the case of elastic spheres.

The problem of the evaluation of the virial coefficients may be divided into two distinctly different ones. The first of these, which is purely combinatorial in nature and is independent of the intermolecular force law, is that of determining the number of a certain type of connected graphs of  $\ell$  points and  $k$  lines which are called stars. This problem is solved by means of generating functions, with the result that the total number of such stars is asymptotically equal to

$$\binom{1/2 \ell(\ell - 1)}{k},$$

for almost all  $k$ . Arguments are also presented which make it very plausible that the total number of topologically different stars is

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$$\frac{1}{\ell} \binom{1/2 \ell(\ell-1)}{k}.$$

With these results the combinatorial problem is essentially solved. In addition to these results, asymptotic results have also been obtained for other types of graphs.

The second problem is that of evaluating certain integrals of functions which depend on the intermolecular potential. With regard to this problem, a solution is not so near at hand. For a purely repulsive force, asymptotic expressions are obtained for the integrals for  $k=\ell$  and  $k=\ell+1$ , but not for the general case. The partial contributions to the virial coefficient for these two cases are, respectively:

$$\begin{aligned} (-1)^{\ell-1} (2b)^{\ell-1} \frac{(\ell-1)}{\ell^{5/2}} \cdot \frac{5}{3} \sqrt{\frac{5}{2\pi}}, \\ (-1)^{\ell} (2b)^{\ell-1} \cdot \frac{5^3 \cdot 2}{\pi \sqrt{3} \cdot 24}. \end{aligned}$$

Because this problem has not been solved in general, it is not possible to make any prediction regarding the asymptotic behavior of the  $B_m$ , or hence about any possible phase transition.

## PHYSIOLOGY

### THE EFFECTS OF INCREASED INTRAPULMONIC PRESSURE ON MUSCLE CONTRACTION, AND THE ASSOCIATED RESPIRATORY AND CIRCULATORY CHANGES

(Publication No. 2589)\*

Leonard Hubert Elwell, Ph.D.  
University of Michigan, 1951

The purpose of this investigation was to study the effects of increased intrapulmonic pressure on muscular contraction, and the associated respiratory and circulatory changes, in anesthetized or decerebrate dogs and conscious humans.

Kymographic recordings were made of respiration using a mercury spirometer, of blood pressure, and of blood flow by the thermopile method. Muscle contractions were elicited directly, by electrical stimulation of the motor nerve or the muscle itself, and reflexly, by tapping the patellar tendon. A glass electrode was used for arterial blood pH determinations. Oxygen saturation of the blood of the human ear was determined with the Millikan oximeter. Intrapulmonic pressure was increased by weighting the Hg spirometer.

Application of 250 mm. H<sub>2</sub>O increased intrapulmonic pressure to dogs, while the tibialis anterior muscle was responding to repetitive motor nerve stimulation, frequently resulted in augmentation of the contractions. Such pressure usually resulted in a slowed and deepened respiration, preceded by a brief initial apnea. Occasionally, extremes of apnea and hyperventilation were recorded. The blood pressure showed an abrupt and marked decrease followed by a variable partial recovery. The systemic blood flow was strikingly decreased. There was evidence that peripheral vasoconstriction played a role in the circulatory adjustments. Carotid arterial blood pH showed a consistent decrease which was modified by respiratory and circulatory variations.

In seeking an explanation for the changes in muscle contractions evoked by increased intrapulmonic pressure, it was found that these changes were not dependent upon any one of the above factors, although they could exert an influence on muscle contraction. The evidence of experiments on hemorrhage, arterial occlusion, muscular activity, asphyxia, and low oxygen and high carbon dioxide administrations, indicated that the alterations in muscle response were associated with a peripheral balance involving metabolites.

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Evidence was obtained which indicated that the locus of action of the factors producing alterations in muscular contraction was the neuromyal junction.

It is suggested that the alterations in muscle response induced by increased intrapulmonic pressure may, at least in part, be explained by a potentiation of neurohumoral intermediation by acid metabolites accumulated in the tissue primarily as a result of the reduced blood flow.

The application of 200 mm. H<sub>2</sub>O increased intrapulmonic pressure to young men regularly enhanced the knee-jerk reflex. The respiratory minute-volume of these subjects was increased: apnea was never observed, even initially, during pressure application. The oxygen saturation of the blood in the ear was usually slightly increased initially, but often declined subsequently. This decrease was attributed to stasis of blood in the periphery.

It was concluded that those factors operative at the neuromyal junction, which are responsible for the alteration of muscle contraction in the dog, are also operative in the augmentation of the reflex in man. It is emphasized that in the intact animal, factors in addition to those acting at the neuromyal junction contribute to the muscle reaction.

## POLITICAL SCIENCE

### CONDOMINIUM AND RELATED SITUATIONS IN INTERNATIONAL LAW; WITH SPECIAL REFERENCE TO THE DUAL ADMINISTRATION OF THE SUDAN AND THE LEGAL PROBLEMS ARISING OUT OF IT

(Publication No. 2532)\*

Abdalla Ali El-Erian, Ph.D.  
Columbia University, 1951

The term "Condominium" has been widely used to describe certain types of joint rule by two or more states or international persons over a territory.

There is no agreement, however, as to the precise scope of the term. The term was not limited to the cases of joint sovereignty, as an inquiry into the historical origin of the term suggests and its proper use dictates. Writers applied the term to other different situations whenever the question of sovereignty in any territory was

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in doubt or restricted in favor of another state, group of states, or an international body.

The disagreement among writers on the scope of the term Condominium can be attributed to the circumstance that the problem has been intimately connected with the controversy between the different schools of writers on the following three subjects: 1) the relation between international law and private law; 2) the distinction between the different types of dependent territories; 3) the befogging problem of sovereignty.

In common with the other subjects of international law related to territory, the Condominium system is an analogy to private law. It can be traced to the Roman law rules of "*Communio pro indiviso*" — undivided joint property.

Dominium in private law is one of the sources from which international law writers drew heavily in formulating the rules applicable to state territory. Supported by the practice of states, Dominium in international law has become identical with territorial sovereignty for which the title to the territory can be set as a criterion.

Thus Condominium is joint sovereignty possessed by two or more states in a certain territory. This excludes from the connotation of Condominium the cases where sovereignty belongs to a state but the actual exercise of it or the factual control of the territory is in the possession of another state, like the cases of leases, military occupation, or interference. It also excludes the cases where sovereignty is in abeyance, as in the cases of mandates, trusteeship, and so-called international cities. Nor should the term Condominium be applied to the cases where territorial sovereignty belongs to one state but at the same time is restricted or qualified in favor of another state or group of states, or the international community, as in the cases of the so-called "resolutive condition," minorities guarantees in the newly born states of the Paris Peace Conference, or the Aaland Islands.

Almost all the cases of international Condominium were set up during the nineteenth century. The remapping of Europe at the Congress of Vienna after the Napoleonic Wars and the frontier as well as the colonial disputes resulted in compromising Condominium arrangements.

Historical Condominia are to be found in Moresnet (1815-1920), Schleswig-Holstein (1864-1866) and Samoa (1889-1899). Existing Condominia are in Andorra (1278- --), the New Hebrides (1906- --), the Neutral Zone between Saudi Arabia and Kuwait (1922- --), and the Canton and Enderbury Islands (1939- --).

The system of dual administration of the Sudan as set up by the Agreement of 1899 between Great Britain and Egypt is not a case of Condominium. Such conclusion is the only one consistent with the

criterion which we set up for Condominium as joint sovereignty in a territory.

The status of the Sudan can be summed up as: an autonomous unit whose sovereignty belongs to Egypt and whose administration is shared by Great Britain in accordance with an Agreement with Egypt.

**SPANISH-AMERICANS AS A POLITICAL FACTOR  
IN NEW MEXICO, 1912-1950**

(Publication No. 2506)\*

**Ernest Barksdale Fincher, Ph.D.  
New York University, 1951**

To political scientists, educators and others interested in majority-minority relations in a democratic society, changes in the once finely adjusted balance between the Anglo-Americans and the Spanish-Americans of New Mexico are of consequence. The steady increase in the Spanish-speaking population in the Southwest and in the urban centers of the North invites attention to the State of New Mexico, where the Hispanic element has been a major factor for more than a century. The educational problems posed by a bilingual population are of considerable interest, and the position of the Spanish-speaking people of the United States affects the Good Neighbor policy of this country.

This study calls attention to the fact that the Spanish-Americans of New Mexico long have been recognized by educators and political scientists as a distinct group, and that constitutional and statutory law extend protection to the Spanish-speaking people. The connection between population distribution and politics is then examined. The effect of the concentration of the Hispanic and the Anglo population in respective counties is seen in the operation of English-speaking and Spanish-speaking blocs. Likewise the steady rise of the Anglo population is shown as basis for Hispanic fears that the Spanish-speaking element is doomed politically.

The historical basis of Anglo-Hispano cleavage is portrayed in terms of divergent views on land ownership, water rights, and societal organization. The impact of an aggressive, capitalistic economy on a feudal economy is noted. Attention then is directed to the socio-economic base of politics in New Mexico. Comparison of the status of Hispanic and Anglo counties indicates that the former are

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visibly disadvantaged. Thanks to vigorous state effort, the educational facilities of Hispanic and Anglo counties are somewhat comparable, although problems arise from bilingualism and the low income of Hispanic counties.

The study considers the role of the church in politics, proceeds to a discussion of the action groups which the Hispanic people have organized to further their interests, and examines the nature of party affiliation. Explanation for the switch of a major portion of the Hispanic-American vote from the Republican to the Democratic party is offered. Likewise the extraordinary interest in politics manifested by the Spanish-speaking people is analyzed. The Hispanic-American is shown to exercise the franchise more fully than his Anglo fellow, and the consequences of this superior voting record are treated.

The profound influence of the patron-peon relationship on politics is considered, and attention is directed to specific areas in which Hispano and Anglo have embraced differing political philosophies and differed as to policy. Among these political conflicts, the controversy over the direct primary, the adoption of an election code, and the passage of fair employment practices legislation emerge as important.

The role of the Hispanic-American in the gubernatorial elections of New Mexico is traced, and mention is made of the "gentlemen's agreement" whereby Anglo and Hispano politicians agreed upon a division of state offices between members of the two groups. Statistics on all state and county offices and on all state political party offices are offered in an attempt to show the distribution of office-holding between Anglo and Hispano.

In the final section, an attempt is made to account for the political subordination of the Hispanic-Americans of New Mexico. This is an assessment of the responsibility of both Anglo and Hispano for the present state of politics, and the recital of social and economic forces which have brought change in the political structure. Finally, an effort to project the problem is made by considering all possible political avenues open to the Hispanic-Americans of New Mexico.

THE ROLE OF THE LATIN AMERICAN STATES IN THE  
ESTABLISHMENT AND PRACTICE OF THE UNITED NATIONS

(Publication No. 2606)\*

John Albert Houston, Ph.D.  
University of Michigan, 1951

This study is intended to examine the contributions of the Latin Americans to the United Nations Charter at the San Francisco Conference in 1945 and the effects of their membership on the subsequent policies and actions of the United Nations to the end of 1949. The subject would seem to be of some significance since it concerns two of the fundamental problems confronting any general international organization: the relationship between large and small powers and the reconciliation of regionalism and universalism.

The study is based primarily on the official records of the United Nations, supplemented by official Latin American commentaries and critiques of Latin American and other publicists.

The record reveals that the Latin Americans made very serious efforts to achieve greater political equality within the organization but that these efforts were largely unsuccessful. The Latin Americans were constrained to accept, most reluctantly, the principle of Great Power unanimity in the Security Council at the same time that they were unable to include more representation thereon for themselves or realize their goal of a flexible amendment procedure that might eventually permit modification of the objectionable unanimity proviso. Their desire to associate the General Assembly more closely with the Security Council in the settlement of disputes was also largely frustrated, as was their attempt to include some provision for compulsory jurisdiction for the International Court of Justice.

Although the purposes and principles of the United Nations, especially as embodied in the Universal Declaration of Human Rights and the Draft Declaration on the Rights and Duties of States, have been influenced more notably by these states, their most important victory was gained in the controversy over regionalism. The genuine freedom of action which regional organizations enjoy under the terms of Article 51 is due in very great part to their insistence at San Francisco that the authentic autonomy of their own inter-American system be preserved.

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Examination of the activities of the Economic and Social Council indicates that the Latin Americans have utilized this organ primarily to further the economic development of their own region, and that the creation of the Economic Commission for Latin America can be explained almost entirely in these terms.

Detailed study of Latin American influence in the handling of important political questions by the United Nations is confined primarily to Spain, Palestine, and the Italian colonies, where Latin American voting power in the General Assembly was a significant factor. The record here shows that although they have not constituted a monolithic bloc of twenty votes, they were extremely influential in the resolution of all three issues.

The general conclusion to be drawn is that although the Latin Americans failed to create a more democratic organization, they were responsible for a formula for regional action that may come to have tremendous significance in world affairs because of the very undemocratic voting procedure they were unable to eradicate, and that should this formula be closely linked with the General Assembly, as seems possible, the political power they have demonstrated in that forum may place them in a position of very great consequence.

#### THE CONCEPT OF THE TWO-PARTY SYSTEM IN AMERICAN POLITICAL THOUGHT, 1789-1888

(Publication No. 2563)\*

Josephine Y. King, Ph. D.  
Bryn Mawr College, 1950

That whole body of theory which may be designated as the concept of the two-party system assumed form and significance in the first century of American political history. When and to what extent various facets of this theory entered the political consciousness and motivated the actions of statesmen and voters is examined through the essays, public addresses and press commentaries of 1789 to 1888. The dissertation contains seven chapters: I, Essential Features of a Two-Party System; II, Theoretical and Historical Bases of the Concept (1789-1824); III, The Recrudescence of the Two-Party System (1825-1850); IV, The Triumph of Sectionalism and Its Consequences (1850-1860); V, Post-War Development (1868-1888); VI, Political Parties and the Study of Government; VII, Conclusions.

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The salient ideological and working principles which, taken as a whole, constitute the concept of the two-party system are: the competition of two major, nationally organized parties, common agreement between the major parties upon the form of government and the basic code of political behavior, compromise within each party of diverse interests to moderate political differences, identification of each major party with a program of administration, alternation of parties, and constitutional opposition.

In the course of the early Federalist-Republican division, three fundamentals of the bi-party concept received practical and, to a lesser degree, theoretical recognition. Constitutional opposition maturing from Jefferson's challenge of Hamilton's policies became a rule of democratic political action. The points at issue between the Federalists and Republicans evolved into alternative party programs offering a genuine choice to the electorate. The election of 1800 introduced the principle of party rotation.

Following the Era of Good Feeling, political combat was revived by two newly-formed organizations, each arising originally as an opposition party. In the 1830's and 1840's, the two-party system was solidly established in national politics through the adroit faculty of Whigs and Democrats to alternate as administration and opposition, through the brilliant development of party organization and strategem and through the implementation of intra-party compromise which, particularly in the case of the Whigs, fused allegiance from disparate elements.

The decade before the Civil War was dominated by two portentous modifications of the two-party concept. The trend toward nationally organized and representative parties was checked by the retreat of the Democracy into the slaveholding South and the emergence of the Republican party in the North. The geographical chasm was widened by an ideological disagreement so severe that the parties advocated antitheses rather than alternatives and the indispensable accord on the maintenance of the Union was shattered. Congressional debates and editorials recognized the threat to the two-party system in its hour of great peril.

Both the Union and the party system required patient mending following the conflict. It was not until the victory of the discredited Democratic party in 1884 that the two-party concept received comprehensive theoretical analysis. The Mugwumps through the liberal press (examined in detail) popularized the theory of the opposition as alternate government and the necessity for disciplining the majority by a rout from office. The quintessence of the two-party system was discovered in the principles of party rotation and constitutional opposition.

Refinement in the 1880's of earlier theoretical contributions provided a sound exegetical basis for practices which had been for

a half century adeptly utilized by the politicians and unconsciously accepted by the voters. Each chapter of the dissertation investigates accretions to the concept in their substantive and environmental manifestations. A brief commentary on the development of party organization and electoral procedure is included. Chapter VI examines nineteenth century school texts and teaching to determine academic recognition of party as an institution of government.

A partial list of the authors and journals quoted in the dissertation includes: Jefferson, the Adamses, Washington, Hamilton, Madison, Monroe, Jackson, Calhoun, John Taylor, Clay, Webster, William Leggett, Seward, Lincoln, Douglas, Carl Schurz, United States Magazine and Democratic Review, N. Y. Daily Tribune, N. Y. Evening Post, N. Y. Times, Harper's Weekly, Atlantic Monthly, and The Nation. The Congressional Globe is extensively cited. Contemporary studies of American politics by foreign observers such as Martineau, Bryce, Tocqueville and Ostrogorski are examined.

**THE COMPROMIS IN INTERNATIONAL ARBITRATION AND  
JUDICIAL SETTLEMENT. A STUDY IN THE EVOLUTION  
OF THE INTERNATIONAL JUDICIAL PROCESS**

(Publication No. 2584)\*

Ruth Catherine Lawson, Ph.D.  
Bryn Mawr College, 1947

Of the techniques resorted to for the pacific settlement of international disputes, only arbitration and judicial settlement embody the attempt to decide controversies by the application of legal principles. In these two methods the beginnings of a judicial process on the international level can be detected.

In common with other methods for peaceful settlement, arbitration and judicial settlement rest on the assumption that no settlement is possible without the consent of the states involved. In arbitration states have customarily given this consent through a special agreement known as a compromis. Despite various designations, the compromis has usually taken the form of a treaty and as such has reflected the caution characteristic of states when making commitments including, increasingly, the requirement of legislative approval prior to ratification. The act of agreeing to arbitrate has therefore been subject to possible obstructions which

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may become apparent at a moment of tension and thus limit the practice of arbitration.

In judicial settlement the compromis has sometimes been employed as in arbitration. Sometimes, however, the compromis has been rendered unnecessary by the existence of permanent courts possessing compulsory jurisdiction, that is, courts able to decide whether cases submitted on the application of one party only come within the jurisdiction conferred on the courts and consented to by states either at the time of their establishment or subsequently, and, if so, to act upon such cases. The distinguishing feature of compulsory jurisdiction is that it may be exercised in a case brought unilaterally, under which circumstances the compromis is neither necessary nor possible.

The progress from tribunals created ad hoc by the parties for single disputes to established courts whose jurisdiction states are committed in advance to accept in certain categories of differences when referred unilaterally, marks the chief development in the evolution of the international judicial process to the present and is of outstanding significance in the emergence of increasingly effective international institutions.

This study is concerned with the nature of the compromis and its focal place in the evolution of the international judicial process. It includes investigation of the use of the compromis as well as of the circumstances under which it may be dispensed with.

The study is based upon an examination of the texts of compromis in the most significant arbitrations and adjudications from 1794 to 1945. Included are all compromis in cases referred to tribunals of the Permanent Court of Arbitration and in those referred to the Permanent Court of International Justice by agreement of the parties. The Appendix lists chronologically the 189 compromis considered, together with the sources of their texts.

Successive chapters treat the nature of the international judicial process, the preparation and approval of compromis, their classification and designation, and their contents. Analysis of contents includes consideration of provisions for the establishment of tribunals, the procedure to be followed, the law to be applied, and the execution of awards.

The contents of compromis show the variety to be expected under conditions that have left states free to include or omit specific details. Many points have actually been left to the informal action of parties subsequent to the conclusion of compromis, or to the discretion of tribunals. In cases referred to tribunals of the Permanent Court of Arbitration states have not usually taken advantage of the fact that they might rely upon the provisions for many details of the arbitration contained in the two Hague Conventions for the Pacific Settlement of International Disputes with consequently shorter



compromis. In cases referred by compromis to the Permanent Court of International Justice, however, the compromis was no longer the basic instrument but became subordinate to the Statute of the Court which covered many points hitherto included in arbitral agreements. As a result, compromis in such cases could be shorter and less varied in content.

## THE EXECUTION OF TREATIES IN THE UNITED STATES

(Publication No. 2557)\*

Paul Bennett Taylor, Ph. D.  
Columbia University, 1951

Each State is free to determine its method of carrying out treaties. Various methods are used by different states to make treaties part of the local law and fix their status therein. In the United States, Article 6:2 of the Constitution, designed primarily to remove the possibility of state interference with treaty performance, makes treaties part of the supreme law. Detailed analysis of the action of executive and administrative agencies and judicial tribunals to give effect to treaties illustrates the fact that no special methods or procedures of treaty enforcement exist. Treaties are treated as law; and no significant distinction is to be seen between their application and enforcement and that of other United States laws.

Treaty performance frequently depends upon Congress. Certain treaties have in some instances been considered not self-executing on the ground that the subject matter lay within the exclusive power of Congress. It is generally agreed that legislation is required to appropriate any funds needed to carry out a treaty, and no treaty has been so drawn up as itself to appropriate money. Whether the constitutional requirement that "bills for raising revenue" must originate in the House of Representatives makes legislation in principle necessary to carry out any treaty that could be deemed a revenue measure has not been decided. If so, application to treaties of the criteria used by the Supreme Court in ascertaining whether particular statutory provisions were revenue measures would seem to lead to the conclusion that very few treaty provisions affecting revenue — e.g., those stipulating for most favored nation or national treatment in respect of duties — would be considered revenue measures. However, in practice, the House of Representatives has

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on the whole won its point that tariff treaties should have the approval of both Houses.

It has been suggested, but never decided that treaties calling for the creation of states, the incorporation of territory, or declaration of war cannot be carried out without legislation.

Courts have in some cases concluded that treaty provisions were not self-executing, because the treaty itself contemplated legislation or because existing law did not include specific provisions needed for enforcement. With a few exceptions, particularly where patent rights were concerned, treaties have been held self-executing unless, after examination, one of the conditions mentioned above was found to exist.

In assisting in treaty execution, Congress has commonly assigned administrative and enforcement duties to particular agencies; vested jurisdiction of cases in particular courts; prescribed penalties for violations; and appropriated money. Many multilateral treaties have regulated subjects which were then coming under national regulation; in legislation to carry out these treaties Congress has established national policies of control.

On the whole, governmental practice and particularly that of the Supreme Court, reveals that the problem of ascertaining whether a treaty is self-executing is not one peculiar to treaties. The design of the treaty, and the ability of the court or other agency, under existing law, to give effect to that design in the particular circumstances must be investigated in each case.

No means exist for compelling Congress to enact necessary legislation; however, few treaty violations have occurred. The apprehensions of both sides in the early controversy over the execution of Jay's treaty have been largely quieted through subsequent experience under the Constitution, and through the growth of general understandings of what is required of the executive and of Congress in order to perform treaty obligations.

THE POSSIBILITY OF A SCIENCE OF POLITICS;  
RECENT EXPRESSIONS OF THE AFFIRMATIVE VIEW  
IN THE WORK OF AMERICAN AND BRITISH STUDENTS

(Publication No. 2560)\*

William Welch, Ph.D.  
Columbia University, 1951

This dissertation aims to describe and evaluate a position concerning the potentialities of Politics widely held in America and Britain during the past quarter century. This position — "Affirmative View" for short — is that the results and methods of Political investigation can be made to conform to the results and methods of Scientific investigation.

The dissertation is in four parts. Part I contains definitions and a preliminary analysis, to which is appended an historical survey of the roots of the Affirmative View. It defines "Science" as knowledge of the external world represented by a systematized collection of descriptive statements, the average of which is highly exact and, in form, highly general and precise. It defines "Politics" as knowledge about legislative organs of government, parties, pressure groups, and publics. It identifies 1) as leading exponents of the Affirmative View: the Americans Gosnell, Lasswell, Merriam, Munro, and Rice, and the Englishmen Catlin and Florence; and 2) as leading critics: Beard, Dimock, Elliott, Friedrich, Morgenthau, and Sait. Finally, it extracts those methodological propositions contained in the Affirmative View which have provoked legitimate disagreement. These are that the Political investigator can 1) be objective, 2) establish serviceable types among his data, and 3) quantify his data.

Part II contains an exposition and critique of representative expressions of affirmation and denial of each of these propositions. It develops the thesis that expressions of affirmation take two forms, the difference deriving from a fundamental difference between accounts given of the method of Science. Underlying one form of affirmation (of Rice and Florence) is the Attributive Account, according to which the Scientist presupposes nothing by way of a Nature-given differentiation of his data. Underlying the second form of affirmation (of Catlin and Munro) and all denials is the Substantive Account, according to which the Scientist presupposes such a differentiation. The analysis gives reasons for supporting the Attributive Account

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and affirming the propositions on this basis. It also, however, stresses the procedural difficulties of establishing serviceable types among political data, and of quantifying political data.

Part III considers the extent to which results reached and procedures followed by certain professedly "scientific" investigations of political phenomena actually do conform to their Scientific counterparts. Successive chapters discuss investigations of voting, investigations of public opinion, and a recent outstanding investigation — Key's Southern Politics. The principal findings are: 1) that when their data are considered purely physical, these investigations conform substantially in respect to objectivity, conform partially in respect to quantification, but fail to conform in respect to the establishment of serviceable types and the building thereon of accurate generalizations; 2) that when their data are considered psychical, the margins of non-conformity noted above are wider; 3) that despite procedural difficulties often overlooked by theorists of the Affirmative View, further investigations can contract these margins.

Part IV contains an over-all estimate of the validity and promise of the Affirmative View. The grand conclusion advanced is that on the basis of the definitions given, and on the basis of the Attributive Account of the method of Science, the Affirmative View is valid. This conclusion, however, is modified by the further conclusion that the procedural difficulties in the way of achieving the end are by no means trivial, and have tended to be underrated. These difficulties derive from the 1) size, 2) mutability, and in particular 3) the psychic nature of political phenomena. A final section attempts to picture the content of a Political Science of which the next one hundred years might see the development.



THE EFFECT OF STIMULUS AREA ON  
VISUAL INTENSITY THRESHOLD

(Publication No. 2569)\*

George Allen Austin, Ph.D.  
University of Michigan, 1951

The purpose of this study is to investigate experimentally the relationship between area and visual threshold brightness of foveally presented stimuli. The major null hypothesis to be tested is that the "area effect," decrease in threshold brightness with increase in stimulus area, can be accounted for on the basis of variables irrelevant to the functioning of the visual threshold mechanisms of the central nervous system.

The stimulus conditions were as follows: monocular presentation with 2.26 mm. diameter artificial pupil; near-monochromatic stimulus of peak wavelength 526  $m_\mu$ ; zero background brightness; fixation distance 10.25 feet; exposure time 0.001 second. The psychophysical procedure employed was a forced choice, temporal interval method of constant stimulus. A total of about 18,000 observations was made by two normal subjects. Data were analyzed by the probit method.

Two auxiliary experiments were performed. In the first experiment there was determined a separation of orientation lights from the test stimulus, 33' visual subtense, beyond which no effect of orientation light separation on stimulus threshold was found. The second auxiliary experiment was designed to test the null hypothesis that variations in threshold for a stimulus of 1' diameter visual subtense do not occur at different locations in the fovea, under the given stimulus conditions. No reason was found to reject the null hypothesis.

In the main experiment of this study threshold determinations were made for fourteen circular stimulus areas, varying in diameter in a geometric progression by steps of  $\sqrt{2}$  from 0.707' to 64' visual subtense. Data for the two subjects agree closely. For stimuli of diameter 2.818' visual subtense and smaller, a straight line relationship was obtained between log diameter and log threshold brightness. For larger stimuli, a curvilinear relationship was obtained, with less area effect occurring for larger stimuli. The area effect was evident for the largest stimuli presented. It is shown that image blurring due to diffraction and the eye's being out of

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focus can account for data for the smaller stimuli, but not for data for the larger stimuli.

It is concluded that the major null hypothesis must be rejected, that the results of the present study showing the area effect cannot be entirely accounted for on the basis of variables outside the visual nervous pathway. Prominent theories of the area effect are found either to be untested by the data or to fail to predict the data.

### SOME EFFECTS OF LEADERSHIP SHARING IN SMALL, DECISION-MAKING CONFERENCE GROUPS

(Publication No. 2573)\*

Leonard Berkowitz, Ph. D.  
University of Michigan, 1951

The purpose of this study is to investigate the relationship between the performance of certain leadership functions by group members other than the chairman, and four criteria of conference outcomes. The hypothesized explanation of the relationships was formulated after many of the statistical analyses had been already carried out.

Seventy-two conferences of groups in business, industrial and governmental organizations were observed. Interviews with the conference participants and questionnaires filled out by them, as well as in-meeting tallies and post-meeting ratings by trained observers, provided information concerning the demographic characteristics of the groups in the sample, their problem-solving and interpersonal behavior, and their satisfactions with the final outcomes of the conference. The dependent variables in this study are the observer ratings and tallies of group conflict, cohesiveness and productivity, and the group rating of the satisfaction with its conference. The measures of leadership sharing are: the leader's control of the group's process, his permissiveness in the area of the content of the group's problems, the extent to which he was functionally differentiated from the others in the group, the proportion of remarks addressed to him, the proportion of all the participations in the group that were accounted for by the other members, and the proportions of all the goal setting, solution proposing and summarizing done in the group that were contributed by the members.

The results suggest that in the present sample conflict tends to increase and satisfaction to decrease, the greater the sharing of

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leadership by members other than the chairman. The correlations between the independent and dependent variables are also examined in groups differing in the extent to which they are in a supporting relationship with the chairman. The results are interpreted as indicating that there are negative reactions (e.g., lessened cohesion, satisfaction) to the performance of leadership functions by the members even when these functions support the chairman. The major hypothesis is developed from this. There appears to be a tradition in the present groups maintaining that the chairman should be the major behavioral leader in the groups, and attempts by other members to influence the group may be reacted to as non-conformity with this tradition.

The above relationships are also investigated in groups contrasted on the permissiveness of their chairmen, the number of members and the urgency of their problems. Few differences from the above results are obtained, except in the case of groups with urgent problems. It is suggested that the motive to reach an adequate decision as quickly as possible becomes stronger than the motive to conform to the hypothesized tradition.

**EFFECT OF THONZYLAMINE, DEXEDRINE AND  
PHENOBARBITAL ON PSYCHOLOGICAL TEST PERFORMANCE  
AND ON SELF-RATINGS OF SUBJECTIVE STATES**

(Publication No. 2530)\*

Robert Edwin Cranston, Ph.D.  
Columbia University, 1951

An experiment was performed to determine the effect of antihistamine compound, thonzylamine, on psychological test performance and on self-ratings of subjective states. For the purposes of comparison, a placebo, dexedrine and phenobarbital were also administered.

Six tests namely, cancellation, tapping, complex reaction task, critical flicker fusion, choice speed test and reading comprehension were used. These tests were selected because they seemed to cover a wide range of psychological functions. A self-rating scale was also used to measure subjective changes.

Twenty-four university students, 18 males and 6 females, acted as subjects. Each subject went through a different sequence of agents. Each agent was evenly distributed over the four testing days,

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thus cancelling out practise effects in the comparison of drug means. The particular chemical agents were administered four hours, two hours, and one-half hour before starting the testing for the day. The doses were either one-quarter grain of phenobarbital, 5 mg. of dexedrine, 5 grains of lactose (placebo) or 25 mg. of thonzylamine.

The data was treated by an analysis of variance technique. No differences between the drug group means on any of the psychological tests or the different self-rating scales were demonstrated by this method.

Through factor analysis, what were called composite performance scores were obtained. These composite performance scores were essentially weighted averages of the scores on five of the psychological tests, namely; cancellation, complex reaction task, choice speed test and reading comprehension. In like manner, composite subjective scores were obtained from four of the self-rating scales, namely; sleepy-alert, bored-interested, depressed-happy, and tense-relaxed.

By the use of a Chi-square technique on the composite performance scores, it was demonstrated that scores under dexedrine were significantly higher than under phenobarbital, thonzylamine and placebo. Also, by the same approach on the composite subjective scores, it was demonstrated that scores under dexedrine were significantly higher than under phenobarbital.

It was concluded that although none of the agents showed any effect on the individual psychological tests or self-rating scales, dexedrine did show a stimulating effect on the over-all psychological performance and subjective states. Thonzylamine and phenobarbital had no demonstrated effect of any kind.

#### THE INFLUENCE OF SOCIAL CLASS MEMBERSHIP ON REACTIONS TO FAILURE

(Publication No. 2583)\*

Elizabeth Ann Malcolm Douvan, Ph. D.  
University of Michigan, 1951

On the basis of previous research, the following general hypothesis was formulated: Because of the central nature of success striving as a motivational force in middle class culture, members of this class will react relatively consistently to failure regardless

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of the special conditions under which it occurs. Working class individuals, on the other hand, since they learn to fear failure less and are less consistently urged to succeed, will react more directly to the specific conditions surrounding any particular failure.

The study was carried out in two public high schools in an industrial community. The sample consisted of 313 students in the senior year of high school. Subjects were classified as middle or working class on the basis of two types of criteria: the occupation of their parents, and their own class identification. Only subjects whose class placements according to both criteria coincided were used in testing the main hypothesis.

The procedure consisted of exposing subjects to one of two failure situations in order to create an unsatiated state of the need to achieve, if such a need was enlisted by the terms of the situation. Subjects were given tests and were told falsely high norms to create the illusion that they had failed to meet standards of other high school students. Following the induced failure, they were given a projective test which was used to measure the degree to which a need to achieve had been aroused in them.

Experimental variation of motivation was introduced to differentiate between the two failure situations. In one group failure was defined purely in terms of failing to meet the announced norms. In the other group, failure entailed the loss of a potential material reward.

The prediction was that while the working class subjects would manifest a significantly higher mean Need Achievement score in the reward condition than in the non-reward condition, the middle class subjects would show no significant difference between mean Need Achievement scores obtained in the two failure situations. The results of analysis substantiated the hypothesis.

A number of other factors were analyzed for their effect on Need Achievement scores in order to dismiss as many as possible of the factors which might provide alternative explanations of the results reported above. Among these were age, sex, and school attended. None of these factors had a significant effect on Need Achievement scores.

## ABNORMAL FIXATIONS

(Publication No. 2587)\*

Albert Eglash, Ph.D.  
University of Michigan, 1951

Four current theories concerning the nature of abnormal fixations, exemplified by the rat on the Lashley jumping apparatus leaping at a locked window when an unlocked one is available, are tested against the data of Maier's frustration experiments.

The theory that the animal is unaware that the nonhabitual window is unlocked when the positive card is in it does not account for the persistence of the fixated response when the card is removed, nor does it account for the fact that fixations are stronger and more numerous after 16 days of random punishment than after eight days.

The second theory, that the animal leaps in order to avoid or escape an air blast, does not account for the fixations occurring when neither air nor any other goad is used.

A third theory, that the fixation differs only in strength of reinforcement from other responses, does not account for the loss in variability occurring in a given animal, for the fact that some animals do not show this loss (do not fixate), nor for the non-normal distributions which reflect these individual differences.

The fourth hypothesis, that the fixated animal is oriented only towards immediate reduction of tension, fear, or anxiety, does not account for the animal's resistance to the negative card.

The null hypothesis of no difference between fixation and these other forms of behavior is rejected: a true difference exists between fixation and failure to solve a problem, avoidance or escape behavior, habit-strength, and behavior directed towards immediate relief from tension.

This analysis of fixation suggests that each animal possesses a limited capacity to endure punishment and still remain flexible. When the limit of an animal's capacity (its threshold) is passed, then the animal for unknown reasons perseverates in its habitual response despite incentives to change. This concept is applied to frustration and avoidance experiments.

This widely-used threshold principle, that accumulating increments summate to produce a qualitative change, has been applied by personality theorists in the form of a threshold of frustration tolerance. Below threshold, a situation stimulates an organism; above,

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it harms the organism. This application of the threshold principle is supported by clinical and experimental observations upon the effects of punishment, anxiety, emotion, motivation, frustration, deprivation, and threat.

Applying the threshold principle in this way suggests a view of abnormal behavior and of perceptual defenses (repression, projection, and introjection) differing from the psychoanalytic view, which emphasizes the reward value of defense and symptom. Psychoanalytic theory and frustration theory are compared with respect to their views on continuity-discontinuity, on the purpose of neurotic behavior, and on the nature of anxiety and of regression. Suggestions were made for further research.

#### CONDITIONS INFLUENCING THE EFFECTS OF TRAINING FOREMEN IN NEW HUMAN RELATIONS PRINCIPLES

(Publication No. 2599)\*

Theodore Hariton, Ph.D.  
University of Michigan, 1951

The main objectives of this study were: 1) to evaluate the over-all effects of training foremen in new human relations principles and 2) to investigate the conditions influencing the effects of training.

The study was made in a skilled trades department of a large public utility. The sample consisted of fifty first-line foremen and the four-hundred non-supervisory employees who reported to them. The sample was split into experimental and control groups which were matched on size, type of work, and level of morale. There were two field divisions in the experimental group and two field divisions in the control group. First-line foremen in the experimental group received training in new human relations principles and techniques while their counterparts in the control group did not. Attitudes of both foremen and employees were surveyed in 1949 immediately before the training course was started. The training course was given by a consulting psychologist. He was assisted by line officials in the trades department who acted as discussion leaders. Attitudes were again measured a year later, three months after completion of the course.

Change in the employees' perceptions of their foremen was used as the basic criterion measure of change in the foremen's

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attitudes and behavior toward the employees. This gave a measure of change which was independent of changes in the foremen's own statements of their attitudes and behavior toward the employees. The conclusions in this study are limited by the kind of measuring instruments used and the timing of the measures. Changes may have taken place which the instrument did not measure.

There was a significant increase in satisfaction with supervision in one experimental division and a significant decrease in satisfaction with supervision in the other experimental division. When these two divisions were combined, the differences were neutralized. The differences between the two control divisions were not significant and did not focus on supervision. One control division showed a slight gain and the other a slight loss. Here also, when the two divisions were combined, the differences were neutralized.

Analysis indicated that the training course was responsible for the differences between the two experimental divisions. While a number of conditions were found to influence the effects of training foremen in new human relations principles, these conditions were not all independent. The variable which was the most highly related to the others was practices of superiors.

Foremen in the experimental division which improved, as compared with foremen in the experimental division which showed negative change, 1) were more receptive to the principles stressed in the course, 2) perceived greater opportunity to try out their ideas on the job, 3) were more satisfied with their superiors and received more encouragement from their superiors to use the principles of the course, 4) indicated greater satisfaction with their jobs, progress, and chances for promotion, 5) expected greater personal benefits if they used the principles presented in the course, 6) felt more secure in their relationships with their superiors, and 7) were more adaptable.

The major conclusion was: training foremen in new human relations principles will be effective in bringing about improvements in employee attitudes toward supervision when the situation within which the foremen operate is conducive to change. Where attitudes and practices of higher levels of supervision are not consistent with the course content, the course not only will fail to bring about any real gain in employee satisfaction with supervision, but may result in a decrease in satisfaction with supervision.

In a conflict situation, the foremen may become less effective in handling their men. This can happen when their applications of the course principles are not supported by their own line superiors. Secondly, even if the foremen handle their men in the same way as before, their men may become less satisfied with supervision because their expectations of better treatment from their foremen were not realized.



## PERSONALITY TYPING: USES AND MISUSES

(Publication No. 2536)\*

Doris Webster Havice, Ph.D.  
Columbia University, 1951

This is a philosophical examination of the type concept in the field of personality study to discuss and evaluate:

1. The validity of the use of such a concept in personality study;
2. The possibility of distinguishing criteria by which its most fruitful use in this field can be determined;
3. The relevance for ethical theory if such a concept can be usefully employed.

Three current psychologies which have the typological method at or near the center of their contributions were selected for examination and comparison. An analysis of the method, the theoretical implications, and the ethical bearings of each are made to show how the type concept was elaborated, what problems this elaboration involves and what further conclusions it leads to especially for moral philosophy. A chapter each is devoted to C. G. Jung's typing according to psychic attitudes and functions, to W. H. Sheldon's typing by body forms, and to Erich Fromm's typing by developmental orientations.

The focus of attention is upon the problem of the material distinctions which have been selected as the basis for classification in each of the typologies examined. In the course of the study certain criteria emerge which might define a good selection of material bases for typing personality. These are:

1. The ground of the distinction must be identifiable and demonstrable in experience;
2. Since personality is here viewed as essentially a dynamic organization of experiences, reactions, and behaviors, it seems reasonable to regard the most significant differentiae of personality as identifiable differences in the way that behaviors, reactions, and experiences are dynamically organized. Empirical evidence which denies or confirms the dynamic interdependence of traits or behaviors in a type of personality is examined;
3. The purpose for which the typology is constructed furnishes a third criterion by which it may be judged. A considerable part of the analysis of each of the theories is devoted to an attempt to express the purposes of each theorist, and to consider their relation to ethical inquiry.

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The study concludes with an evaluation of each of the theories from the point of view of these criteria and a plea that on the basis of these contributions a more adequate typology be developed by the psychologists in order to facilitate the development of a more scientific ethics.

**A STUDY OF SOME PSYCHODYNAMIC DETERMINANTS  
OF COMPULSIVE CONFORMITY IN A TASK  
INVOLVING LINEAR JUDGMENTS**

(Publication No. 2604)\*

Martin Leon Hoffman, Ph.D.  
University of Michigan, 1951

This study was proposed as an attempt to increase our understanding of the mechanism by which some individuals distort their perceptions of reality so that they agree more closely with what is perceived to be the majority view. More specifically, the aim was to investigate some of the psychodynamic determinants of this compulsive need to conform.

The author drew from the theoretical and empirical psychoanalytic literature and formulated a theoretical statement concerning the foundations of compulsive conformity as laid in early childhood experiences in the home. The hypotheses to be tested are embedded within this formulation.

Compulsive conformity was defined in terms of the extent to which reported judgments of two linear distances were influenced by announcements of average judgments for the group. The announced averages were manipulated by the experimenter so that their influence led to less accurate judgments. From a sample of three hundred and seventy-three beginning psychology students two extreme groups of subjects were selected for study on the basis of their performance on this measure. One group consisted of those thirty students whose judgments shifted most in the direction of the announced group average. The judgments of the other group of thirty subjects shifted least in either direction, that is, toward or away from the announced average. The two groups chosen were roughly controlled for age, sex, university classification, and seating position with respect to the judged stimuli. For practical reasons thirteen of these subjects dropped out of the study before its completion, leaving twenty-seven in the conforming group and twenty in the non-conforming group.

Hypotheses were tested by comparing the responses of these two groups on a sentence completion test, two attitude-type question-

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naires, and thirteen cards selected from the third revision of the Thematic Apperception Test. Scoring of the T.A.T. and the sentence completion test was based on an objective content analysis, and, in most instances, was done by two independent judges.

The findings provide a great deal of support for the hypotheses. Thus, the subjects in the conforming group indicate that they have relatively more domineering and coercive parents, repressed hostility toward their parents, and guilt. They manifest intro-punitive handling of hostility, over-concern with the welfare of and over-idealization of their parents, positive attitudes toward authority and toward conformity to the group, and an overly strict moralism. These characteristics are interpreted as defenses against guilt. The conforming subjects also indicate that they are less able to accept responsibility and cope with the problems of life and less able to tolerate their own impulses. In addition, they show relatively great agreement with their parents and friends on political and religious attitudes and hold more traditional religious beliefs and conservative political attitudes.

Thus, it has been demonstrated that certain individuals possess a constellation of personality characteristics which predispose them to conform to others, and that this need to conform can influence what appears to be a "peripheral" process, the judgment of a short linear distance.

#### FOREMAN-STEWARD PARTICIPATION PRACTICES AND WORKER ATTITUDES IN A UNIONIZED FACTORY

(Publication No. 2609)\*

Eugene Henry Jacobson, Ph.D.  
University of Michigan, 1951

As part of a larger program of research on the determinants of effective performance of large organizations and the determinants of individual worker satisfaction in such organizations, a study was made in an automobile factory to investigate relationships between supervisory practices and worker attitudes.

This study reports an analysis of the way in which behavior of the factory foreman, as a representative of management, and the industrial union steward, as a representative of the union, is related to worker attitudes toward management and the union. Particular attention is paid to the interaction among foremen, stewards and workers and the relationship that this interaction has to worker use of company or union values.

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Data were gathered during intensive personal interviews with all of the foremen, all of the stewards and a random sample of all of the workers in the sixty-seven major factory work departments. During home interviews, 333 foremen, 353 stewards and 462 workers were asked fixed series of questions by trained interviewers on the staff of the Survey Research Center at the University of Michigan, and the recorded answers were converted into numerical categories for analysis with punched card equipment.

To study interaction, foremen were asked if they involved workers in joint decision making, and workers were asked if foremen involved them. In a similar fashion, it was determined whether stewards involved workers in joint decision making. On the basis of these reports, work departments were classified into groups that differed in amount of reported worker-foreman and worker-steward interaction. Then, workers in groups of departments that differed in amount of interaction were compared on a number of attitudes toward the work situation.

The data tend to support the conclusion that foreman and steward behavior is related to worker attitudes toward the company and the union. In departments where company foremen are more likely to involve workers in joint decision making, workers are more likely to use company values and norms rather than those of the union. This tendency is more marked if, in those departments, the union stewards are not likely to involve workers in decision making. In departments where the union stewards do actively participate with the workers, the workers are more likely to use union values and norms rather than those of the company, particularly in those departments where the foreman is not active. Where both foreman and steward are active, workers tend to take a less polar position with respect to union and management.

A rationalization of these findings is built around the expectations that workers have of foreman and steward behavior that are a function of standard roles that the latter take with respect to the workers, and standard roles that they have as surrogates for the larger groups, the company and the union. Because the steward is expected to work closely with the men, for instance, if he does not, they will be less likely to perceive that the union is functioning as it should.

A theoretical discussion of the decision making process points to further investigation of limitations on its outcomes that are a function of situational determinants, content, and the nature of the process. Limitations on the extent to which foreman and steward behaviors can influence worker attitudes toward the larger group are discussed with respect to alternative means the worker has for relating to the larger group.



## THE RÔLE OF THE MOTOR RESPONSE IN LEARNING

(Publication No. 2615)\*

Donald Walker Lauer, Ph.D.

University of Michigan, 1951

The rôle of the motor response in learning has for many years been a topic of controversy among psychologists. Viewpoints can be narrowed down to two: the first, or "peripheral," position, that learning is the formation of a connection between a state of stimulation and a motor response; and the second, or "central" position, that the whole process can take place within the central nervous system — that the motor response plays no essential role in learning. Physiological-psychological approaches to this problem are reviewed and evaluated.

The procedure is designed to demonstrate that learning can occur without a motor response. A conditioned leg flexion in response to a buzzer is established in a dog while all striate muscle activity is eliminated by d-Tubocurarine. A shock to the webbing of the foot is used as an unconditioned stimulus. Evidence for the establishment of the response is obtained, although no overt movement can be observed, through a record of nervous potential from the saphenous branch of the femoral nerve. A chronic electrode with a mercury lead is attached to the nerve at that point, and is led subcutaneously to its place of emergence on the back of the dog. This branch of the saphenous nerve innervates the sartorius muscle; hence appropriate nervous potential can be interpreted as a "leg-flexion response." The training procedure under d-Tubocurarine was designed so that the dog could avoid the shock by delivering a "leg-flexion" potential to the buzzer before the occurrence of the shock.

The results indicate that a response can readily be established under these conditions. Further, when the dog is no longer under the influence of the drug, the neural response as well as the corresponding striate muscle response is observed.

It is concluded that the overt muscle response, 1) as a muscular movement or 2) as a source of afferent feed-back to the central nervous system, is not an essential component in learning.

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## THE RELATIONSHIP BETWEEN PERSONALITY AND EFFICIENCY IN VARIOUS HOSPITAL OCCUPATIONS

(Publication No. 2510)\*

Solomon Levine, Ph.D.  
New York University, 1951

The present study was undertaken to explore the relationship between personality and efficiency as an employee in three hospital occupations. A total of 158 subjects were studied including 69 hospital attendants, 46 food service workers and 43 clerical workers employed in a large Veterans Administration Hospital in New York City.

The order of merit ranking was employed as the criterion measure. Each subject was ranked by two independent qualified raters on the basis of job efficiency. Three personality measures, the Minnesota Multiphasic Personality Inventory (group short form), the Cornell Index and the Graphomotor Projection Test, and one intellectual measure, the SRA Primary Mental Abilities (Intermediate form A H) were administered.

A variety of statistical techniques were employed to determine whether significant relationships exist between efficiency and the personality and intellectual factors measured by the battery of tests. These techniques included the *t* test of significance, the chi-square test and correlation analysis. The *t* test of significance was used in comparing the test scores of the highest and lowest ranking 25 per cent, 33 1/3 percent and 50 percent of the population of each occupational category.

No significant relationship was discovered between personality and hospital attendant efficiency. None of the personality tests differentiated between efficient and inefficient hospital attendants. Intellectual factors, however, consistently differentiated between efficient and inefficient subjects. The efficient hospital attendant achieved significantly higher mean scores on each of the Primary Mental Abilities.

No consistent significant relationship was discernible between efficiency as a food service worker and either personality or intellectual factors. A probable significant relationship is suggested on the Schizophrenia scale. A significant difference was found on this MMPI scale only when the test scores of the upper and lower quarters were compared and the *t* test applied. Since significant results

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were not revealed on any of the other statistical techniques the difference observed may be due to chance factors and cannot be considered conclusive. However, there are probably differences in gross psychopathology among efficient and inefficient food service workers, evidenced by significant differences found on the Cornell Index. The least efficient food service workers showed a significant greater trend towards maladjustment on the Cornell Index.

Scattered significant differences in intellectual factors were found among the clerical workers; these differences are much less extensive than that found among the hospital attendants. Two Primary Mental Abilities, Verbal Meaning and Number, discriminated most clearly between the most and the least efficient clerical worker. Significant personality differences were obtained on at least two Minnesota Multiphasic Personality Inventory scales. The inefficient clerical worker produced a significantly higher mean score on Schizophrenia and Psychasthenia scales revealing a greater trend to maladjustment in these personality areas. There are probably differences in gross psychopathology, as evidenced by the MMPI and further shown on the Cornell Index. The least efficient clerical worker presented the significantly more maladjusted score on the Cornell Index.

When the three occupational categories are combined, the importance of intelligence comes out quite clearly. Some MMPI variables seem to discriminate (Hypochondriasis and Depression, and possibly Psychasthenia and Schizophrenia). Over-all psychopathology as measured by the Cornell Index is clearly discriminatory.

The effectiveness of the psychological tests depends on the occupational category in which they are employed. Test scores on intellectual factors are consistently related to efficiency in the hospital attendant category, occasionally related in the clerical workers category and not at all related among food service workers. On the MMPI, some of its measures are differentiating among clerical workers, only a trend towards differentiation is seen on one of its measures among the food service workers but no differentiation is shown among the hospital attendants. When a gross measure of psychopathology is used, it proved effective among the clerical workers and food service workers but not among hospital attendants. The Graphomotor Projection Test was not at all significant in discriminating between efficient and inefficient employees in any of the occupational categories.

The multiple correlation analysis indicates that by ideally weighting the various personality and intellectual factors measured in this study, employee efficiency can be predicted to the extent expressed by the multiple correlation of .597 and .622 for hospital attendants and clerical workers, respectively.

RELATIONSHIPS AMONG SOCIO-POLITICAL ATTITUDES  
OF ADOLESCENTS, SOCIO-POLITICAL ATTITUDES  
OF THEIR PARENTS, AND SOME MEASURES  
OF ADOLESCENT HOSTILITY

(Publication No. 2542)\*

Kenneth George Lucht, Ph.D.  
Columbia University, 1951

A battery of attitude scales and personality tests were given to 166 high school seniors. The same battery of attitude scales (but not the personality tests) were given to their parents. The attitudes of parents and their children were intercorrelated, as were the attitudes of children and the personality factor measured by the personality tests (personal feelings of outwardly directed hostility). The attitudes measured were attitudes toward: Russia (scale constructed by author), international relations (scale constructed by author), war (a 16-item Likert-type version of the Droba scale), and humanitarianism (Ferguson's scale for the measurement of primary social attitude #2). The personality tests used were Rosenzweig's P-F Study (only the extrapunitive score was used) and a Like-Dislike scale adapted by the author from a scale used in the evaluation of the 8 year study. Certain other information was obtained by means of interviews with parents.

The main findings of the study were as follows:

1. Attitudes of adolescents toward Russia were significantly related to their mothers' attitudes toward Russia ( $r = .28$ ) and to their fathers' attitudes toward Russia ( $r = .18$ ). Adolescent attitudes toward international relations were significantly related to their fathers' attitudes toward international relations ( $r = .27$ ), and adolescent attitudes toward war were significantly related to their mothers' attitudes toward war ( $r = .16$ ).

2. Adolescent attitudes toward international relations were significantly related to both measures of adolescent hostility ( $\bar{r} = .22$ ), and adolescent attitudes toward war were significantly related to adolescents' hostility score on the Like-Dislike scale ( $r = .16$ ).

3. Adolescent attitudes toward Russia were more closely related to their parents' attitudes toward Russia than to their personal feelings of outwardly-directed hostility.

4. Adolescents tended to have attitudes similar to those of their fathers on the "ideological" items of the attitude toward

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war scale ( $r = .23$ ), but different attitudes from those of their fathers on the "personal participation" items of the scale ( $r = .22$ ).

5. There were indications of a tendency for the relationship between adolescent and parental attitudes to be greater for concrete specific items from the attitude toward international relations and attitude toward war scales than for the abstract ideological items from these scales, and for the relationship between adolescent attitudes and the measures of hostility to be greater for the abstract ideological items than for the concrete specific items from these scales.

6. Mothers as a group had significantly more homogeneous attitudes than adolescents as a group on all attitudes except humanitarianism and the "ideological" items of the international relations scale.

7. Amount of conversation in the home about international relations bore no statistically significant relationship to the adolescent attitudes studied or to the degree of relationship between adolescent and parental attitudes.

8. Intelligence, as measured by the Thorndike 20-word vocabulary test, was found to be significantly correlated with attitudes toward international relations and war.

9. Frequent church attendance was found to be reliably associated with less liberal attitudes toward international relations.

10. There was no relationship between parent contact with other countries and attitudes of parents and children.

### EMPATHIC ABILITY AND SOCIAL PERCEPTION

(Publication No. 2618)\*

Margaret E. B. Barron Luszki, Ph.D.  
University of Michigan, 1951

This is a study of two components of social perception, or "empathic ability," and of characteristics of persons possessing one or the other or both of these components. The study emerged from the practical training problem of why some people are unable to see more than the most obvious superficialities of a role playing scene or other demonstration. It was postulated that one important reason for this was lack of empathic ability.

The two components of empathic ability studied are: 1) the ability to judge how other persons feel about themselves, and 2) the ability to judge the feelings of others about oneself. The processes

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involved in socialization and in learning to "take the role of the other" are proposed as a theoretical framework within which predictions are made relating to the incidence of these two components of empathic ability, their relationship to perception of role playing, and the personality factors associated with them.

Three principal types of measures, the first two of which were developed specifically for the present study, are used to test the hypotheses: 1) a series of parallel self-other rating forms which measure the two empathic skills noted above and which also yield a number of scores regarding the nature of the self concept and the self-other relations of the subjects; 2) measurement of the ability to observe role playing from two different points of view: a) to evaluate the performance and observe it critically, and b) to identify closely with one of the actors; and 3) the Guilford-Martin Inventories of Factors GAMIN and STDCR and the F-scale.

Findings support the distinction of two empathic skills. The ability to judge the feelings of others about oneself is a less common skill than the ability to judge how other persons feel about themselves. There is, however, a slight tendency for the two skills to be associated, and persons possessing both in good degree also tend to possess the following other characteristics: 1) ability to "see" what is happening in the role performance of others; 2) good personal adjustment; 3) insight, as indicated by a self evaluation which is similar to the evaluation made of the subject by others; 4) stable, positive, and secure feelings about the self, and 5) consistent and favorable perception by others. The ability to judge the feelings of others about oneself is much more highly associated with each of these characteristics than is the ability to judge how others feel about themselves. Findings also support the predicted association a) between the ability to judge the feelings of others about oneself and the ability to establish close identification with an actor, and b) between the ability to judge the feelings of others about themselves and the critical, evaluative observation of role playing.

Although there are yet many unanswered questions, the good relationship between predictions on the basis of theory and findings indicates a promising first step both for a better understanding of what is involved in empathic ability and for the application of scientific research methods to the study of role playing.

# PERSONALITY CHARACTERISTICS AND THE RESOLUTION OF ROLE CONFLICTS

(Publication No. 2625)\*

Elliot George Mishler, Ph.D.  
University of Michigan, 1951

The purpose of this investigation is to determine the relationships between certain personality characteristics and particular ways of resolving a special type of role conflict.

Four situations involving a conflict between obligations to one's friend and other social obligations were used in questionnaire form and a "scalogram analysis" of these items is presented. Essentially an individual was asked if he would give his friend "a break" if doing this resulted in violating another social norm. A tendency to give one's friend "a break" in these situations was labelled Particularistic; the opposite tendency was called Universalistic.

An analysis of the personality structure relevant to behavior within a universalistic social system, i. e., bureaucracy, led to the selection of seven personality characteristics which had been emphasized in earlier studies on the "authoritarian personality." These were concerned with the following areas:

1. Interpersonal relations
2. Attitude to parents
3. Attitude towards opposite sex
4. Impulse control
5. Evaluation of deviant behavior
6. Attitude to authority
7. Achievement values

A sentence completion test was specifically constructed to measure these characteristics. Two methods of scoring this test were developed. One of them involved scoring individual sentence stems and their responses in terms of a previously determined set of categories and is called the Weighted scoring procedure. The other scores were clinical global judgments of the entire sentence completion protocol and are called Ratings. These two methods of scoring sentence completion protocols provided comparable results for the personality characteristics and supplemented each other in the analyses.

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In addition, two attitude scales (drawn from the studies of the "authoritarian personality") measuring "ethnocentrism" and "implicit anti-democratic trends" were also administered.

Although considered tentative and in need of further confirmation, the following conclusions are drawn from the analysis of data:

1. Individuals who resolve role conflicts in a Universalistic fashion tend to be less ethnocentric than those who resolve them in a Particularistic fashion.

2. Particularistic persons tend to be characterized by cynicism and generalized hostility towards people. In terms of our specific personality characteristics they tend to: reject the demands of authority figures, view the deviant behavior of others with permissiveness, accept the expression of their own impulses, appraise their parents objectively, believe the sources of satisfaction and security lie in the achievement of external goals, are disrespectful to and resentful of the opposite sex, and look upon the "world as a jungle."

3. Universalistic persons present a picture of general submission to authority and adherence to a conventional ideology. Specifically they tend to: submit to the demands of authority figures, condemn the deviant behavior of others in a moralistic fashion, control the expression of their own impulses, conventionally idealize their parents, believe the sources of satisfaction and security lie in the achievement of individualized, personal goals, have genuine affectionate respect for the opposite sex, and an open, trusting attitude towards people.

4. An hypothesis is suggested that, in the role conflict situations used, Particularistic individuals are not responding positively to the friend but are responding negatively to the authoritarian, conventional values involved in the situations. That is, it is not empathy for a close friend in a predicament, but the opportunity to align themselves with a violator of a social norm which determines their action.

In conclusion, the results of this investigation for the development of systematic theory in social psychology are indicated.



## SATISFACTION WITH CONFERENCE DECISIONS

(Publication No. 2634)\*

Jack Nathan Peterman, Ph.D.  
University of Michigan, 1951

The purpose of this investigation is to explore and define the relationships, in decision-making meetings, between the participants' satisfaction with decisions and a number of antecedent in-meeting and pre-meeting factors.

Seventy-two real-life meetings, involving a total of 700 individual participants, were observed in business, industry, and governmental agencies. Questionnaires submitted to, and interviews with, each of the participants in the meetings, as well as in-meeting tallies and post-meeting ratings by trained observers, yielded information concerning: background characteristics of the group, their problem-solving and interpersonal behavior and attitudes in the meeting, and their satisfaction with the final outcomes at the end. Their satisfaction with decisions reached, is used as the criterion measure in the analysis.

Each factor measure is first evaluated in terms of: its correlation with the criterion (satisfaction with decision), its reliability (determined by split-half, and inter-observer, correlations), and its relationship to the other factor measures. Of 93 different measures examined, this analysis yields nine single-measure, and two multi-measure, "crucial," significant factors. The interrelationships among these crucial factors, as they influence the relationship of each to satisfaction with decision, constitutes the definitive aspect of the analysis.

The results indicate that under certain, specified, conditions the following relationships hold:

1. The greater the amount of time devoted to each topic in a meeting, the less satisfying the decisions to the group.
2. The longer the meeting as a whole, the less satisfying the decisions.
3. The larger the proportion of items that are completed, the more the group tends to be satisfied with the end-results of its deliberations.
4. The more each participant is satisfied with what he did in the meeting, the happier is the group, as a whole, with its decisions.

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5. There is a tendency for the group to judge its decisions as satisfactory when the goals of the participants are congruent.

6. Decisions reached in meetings in which the procedures are leader-centered tend to be more satisfying than those reached in meetings that are group-centered.

7. Groups, which are perceived as unified by the participants, reach decisions that are more satisfying than those that are not thus perceived.

8. The more inter-member, substantive, support there is in a meeting, the more likely it is that the group will perceive the final decisions as satisfactory.

9. The presence of cliques in a meeting is associated with a decrease in satisfaction with decisions.

10. Positive affective atmosphere in meetings (i. e., the general pleasantness of the total situation) as well as the overall attitude (positive-negative) to the group's general effectiveness, are both associated with decisions that are judged satisfactory.

The above relationships, however, are in many instances contingent on the "situation" as defined by one or more of the other factors. Thus, for example, the relationship between satisfaction with decision and time devoted to each topic holds true only in meetings that are leader centered, where a relatively small proportion of attempted tasks are completed, or where the general affective atmosphere is low. Similarly for the other factors. The findings repeatedly underscore the fact that the outcome of meetings cannot be adequately explained in terms of one or more single variables, but must be approached in terms of multi-factor determination. Each factor has meaning only when considered in conjunction with other, concurrently operating, "situational" conditions.

#### A STUDY OF PRESTIGE AND BEHAVIORAL CONTAGION IN CHILDREN'S GROUPS

(Publication No. 2635)\*

Norman Alhurt Polansky, Ph.D.  
University of Michigan, 1951

The purpose of this study is to test the hypothesis that the initiation of behavioral contagion in children's groups is a function of the prestige of the initiator. Also submitted to testing were hypotheses related by theory to the above predicting a positive relationship

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between prestige and ability to exercise influence directly, reciprocity of deference behavior as a function of prestige, readiness to attempt influencing as a function of prestige. It was also postulated that under appropriate conditions dynamics independent of interpersonal relationship may underly occurrence of contagion.

Data was obtained in two summer camps for children. A total of sixteen groups were studied for four weeks each. The methodology employed involved: 1. Observations of social interactions in the groups by observers using precategorized instruments designed to measure contagious and direct influence; 2. Near-sociometric interviews with group members to measure prestige; 3. Rankings by counsellors to provide data on personality characteristics.

Results indicate that high prestige children are more frequent initiators of behavioral contagion and of successful direct influence attempts. They receive more deference behavior from other children. They are considered to be more secure in their groups, appear to be more socially active, and are more directive in their manner of attempting influence. In a small series of experiments, it was demonstrated that in a situation of group frustration, however, the impulsiveness of the individual child is a more successful predictor of his potential for initiating behavioral contagion than is his enduring group prestige.

It is concluded that the prestige attributed a child by his cabin-mates affects his concept of his own group position, and results in complementary behavior on his part. It is also noted that behavioral contagion may have other causes, besides the relationship of initiator and recipient, which are important to understanding this phenomenon.

#### THE RELATIONSHIP BETWEEN PSYCHOLOGICAL DATA AND PROGNOSIS IN PSYCHOTHERAPY

(Publication No. 2511)\*

Bertram Pollens, Ph.D.  
New York University, 1951

This investigation evaluated the use of psychological data in prognosticating the results of psychotherapy. Ten psychotherapists at the New York Mental Hygiene Unit of the Veterans Administration reviewed their case-loads, each consisting of 20 to 30 patients, for the purpose of selecting those whom they considered to be the

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"most improved" and "least improved." This resulted in the identification of 25 patients as "most improved" and 23 patients as "least improved." In order to evaluate the reliability of these judgments, two psychiatric social workers independently rated the subjects on the basis of degree of improvement. One social worker agreed with 95% of the judgments made by the psychotherapists, and the other social worker agreed with 93% of those judgments. In every case at least two of the three judgments were in agreement.

The psychological data included scores secured by administering the Wechsler-Bellevue Intelligence Scale, the Bell Adjustment Inventory and the Rorschach Test. These tests were all administered when the patients began psychotherapy. In addition, three rating scales were completed for each patient by the ten psychotherapists at the conclusion of psychotherapy. The first of these scales included 47 variables of personality, the second included descriptions of five basic personality types, and the third contained eight pairs of trait clusters derived by factor analysis.

The groups were compared with respect to age, education, diagnosis, and duration of therapy. The means were computed and the t-test applied. None of these factors was found to be significant at the .05 level of significance.

The Wechsler-Bellevue data revealed that both groups were in the superior range of intelligence, that the mean I. Q. of the improved group was slightly higher than that of the unimproved group, but that the difference was not significant at the .05 level of confidence. Neither the Wechsler-Bellevue sub-test scores, the intra-test scatter, nor the inter-group differences were significant at the .05 level of confidence. Neither the method of discriminant function nor the t-test revealed any significant differences with respect to Bell Adjustment scores.

The Rorschach data were analyzed for the purpose of securing information related to the following questions: 1) Are any of the scoring components associated with prognosis?, 2) Is a Rorschach protocol in its entirety related to prognosis in psychotherapy?, 3) Does the Rorschach reveal specific personality variables which are significantly associated with good prognosis? The data supplied affirmative answers to each of these questions. Six Rorschach scoring components, namely FC, Fc, D, FK, P, and R were significant at the .05 level of confidence. In answer to the second question, it was found that three psychologists were able to identify those Rorschach protocols associated with good prognosis in therapy. The tetrachoric  $r$ 's expressing the correlation between the psychologists' judgments and the eventual outcome in therapy were found to be .89, .83, and .62, respectively. All of these correlations were significant at the .01 level of confidence. In answer to the third question, it was found that affective flexibility, self-doubt, activity,



and ability to empathize, as revealed by the Rorschach protocols, were associated with good prognosis at the .05 level of confidence.

Ratings of patients by psychotherapists indicated that fourteen of the sixty variables described on the three rating scales were significantly associated with improvement in psychotherapy.

### SOME PICTURE STORY CHARACTERISTICS AS MEASURES OF PERSONALITY TRAITS OF CHILDREN

(Publication No. 2642)\*

Egan August Ringwall, Ph.D.  
University of Michigan, 1951

The purpose of this study is to investigate the relationship between emotional adjustment in children and a number of measures of picture story characteristics which are commonly used in the analysis of picture stories. From the files of a research project which has developed a new picture story test, the story protocols of 67 fifth grade public school children and 20 children from child guidance clinics are selected for analysis. Teacher's ratings on four items selected from a rating scale of pupil adjustment are used as the external criterion of emotional adjustment for the school group. A total of 27 indices selected from the studies in the literature are used as objective measures of various story characteristics.

In a preliminary analysis, the relationship of intellectual level and parental occupational level to emotional adjustment ratings is presented. Then the investigation of the differential effects of differences in schools, form of the test administered, and the sex of the child is given for each of the indices. The results of two separate analyses of the relationship between emotional adjustment and each of the indices are then presented: the first analysis is for the school group alone, while the second is a comparison between a well-adjusted sample from the school group and the maladjusted clinic group.

The following are the major results of this study:

1. Intellectual level and occupational level are not significantly related to ratings on emotional adjustment.
2. The form of the test administered and the school of the child are not related to the measures of story characteristics.
3. Significant sex differences are found on two of the measures.

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4. Ten measures of story characteristics are significantly related to the ratings of emotional adjustment, and for eight of these measures the direction of the relationship is in agreement with other studies.

5. Clinic children and poorly-adjusted school children reflect different patterns of mean scores on the measures.

The general conclusion is that it is possible to derive objective measures of story characteristics which are significantly related to the criterion measure. These story characteristics are thus applicable in the analysis of children's picture stories. The direction of the relationship between these measures of story characteristics and the ratings of emotional adjustment is in agreement with the results of other investigators who have used these measures with groups which have differed in age and level of adjustment.

IDENTIFICATION WITH THE AGGRESSOR;  
SOME PERSONALITY CORRELATES OF  
ANTI-SEMITISM AMONG JEWS

(Publication No. 2647)\*

Irving Sarnoff, Ph.D.  
University of Michigan, 1951

This study is concerned with the application of the Freudian theory of identification with the aggressor to an investigation of Jewish anti-Semitism. From this theory, we selected three broad personality dimensions on which persons who identify with the aggressor are presumed to differ from persons who resist the use of such a mechanism of defense. These dimensions are: 1) attitudes toward the parents; 2) attitudes toward the self; 3) methods of dealing with hostility directed toward the self by others.

Six general hypotheses and twenty-three specific predictions were derived to test for the expected differences, on the three dimensions listed above, between Jews who adopt (identify with) the anti-Semitic attitudes circulated by majority group bigots and Jews who reject (do not identify with) these biased attitudes concerning their own minority group.

Our measure of identification with the aggressor was an anti-Semitism scale devised for Jewish subjects. This was administered to 100 Jewish male students at the University of Michigan. We divided

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this sample into two approximately equal groups on the basis of their anti-Semitism scores.

Abbreviated forms of the Michigan Sentence Completion Test and the Thematic Apperception Test were used as measures of the personality variables.

The Chi-square method and Fisher's Exact Test were used to determine the significance of the difference between the number of Highs (anti-Semitism) and Lows (anti-Semitism) who manifested the possession of any given personality variable.

Subjects classified as High in the anti-Semitism distribution differed from those in the low category in the following predicted ways:

1. The Highs had more negative attitudes toward their parents.
2. The Highs had more negative attitudes toward themselves.
3. The Highs tended to be more frequently passive in the face of interpersonal hostility.
4. The Highs had fewer positive attitudes toward their parents.
5. The Highs had fewer positive attitudes toward themselves.
6. The Highs were less prone to actively retaliate against aggressors.

All of the specific predictions which were formulated to test the six major hypotheses listed above, yielded results in the expected direction.

In general, the results support the assumption that personality factors can contribute to the development of the phenomenon of Jewish anti-Semitism.

### THE CONCEPTS OF GROUP RELATIONS IN FREUDIAN PSYCHOANALYSIS

(Publication No. 2513)\*

Saul Scheidlinger, Ph.D.  
New York University, 1951

#### Purpose

The purpose of this investigation was to examine the Freudian writings pertaining to group relations. The major concepts and ideas in these writings were assembled and formulated within the framework of a logical whole. They were also related, where

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possible, to pertinent psychoanalytic propositions in the realm of individual behavior.

### Delimitations and Assumptions

This study was limited to the examination of the relevant theories evolved by Freud and those writers generally recognized as adherents of the "orthodox Freudian" school of psychoanalysis. Contributions dealing with the psychodynamics of individual behavior and psychoanalytic treatment were not used, except insofar as they related to Freudian theories of group behavior. Similarly excluded were anthropological precepts regarding the relationship between culture and the individual as well as Freud's phylogenetic concepts.

It was assumed that the basic findings of Freud and his co-workers are valuable for the full understanding of individual and group behavior; also, that behavior is subject to unconscious as well as conscious motivations.

### Methods and Procedures

The plan was to extract from the Freudian literature the material dealing with group relationships. After assorting the essential concepts, they were examined as to their internal consistency. The next step involved a meaningful formulation of the propositions with regard to the following general headings:

- Origins and nature of gregariousness in humans.
- Meanings of group membership to individuals.
- How groups acquire influence upon members.
- Processes making for group cohesiveness or conflicts.
- The leader's role.

In this connection, some authorities from allied fields were quoted when their views seemed to bear direct relationship to Freud's.

The Freudian concepts of group behavior were also explored in relation to similar concepts in the realm of individual behavior, and to psychoanalytic theory in general. A distinction was made between individual and group psychological elements at work in any group situation. The general nature of the Freudian group theories, their orientation, their weaknesses and strengths were assessed. Some of the ways were outlined in which these theories have found or might find application in selected fields of group study, such as social psychology, sociometry, group work, and group psychotherapy. For this latter purpose, the views of authorities in the field under discussion, as well as the investigator's own, were utilized.

### Findings

The Freudian concepts of group relations discussed in this study were viewed as hypotheses requiring further clarification and verification.



These concepts were found not to cover the total range of group phenomena, and to be even less definitive than the psychoanalytic theories of individual behavior.

However incomplete or even unclear, these same concepts were considered useful — particularly insofar as they stressed the frequently neglected unconscious motivations and processes in group behavior. These propositions have to date not gained general recognition among students and practitioners in the realm of group behavior. Ignored by certain writers, they have been subject to considerable misinterpretation by others. While accepting Freud's basic precepts in such fields as psychopathology and therapy, some authors, at the same time reject his ideas in regard to groups.

While some confirmation of selected Freudian tenets seems to have come from reports by workers in related fields, very few, if any, of these were obtained in a controlled and systematic manner.

Despite methodological obstacles, further study of the Freudian group concepts was viewed as necessary to enhance their scientific value. Focus on the following three approaches might be most fruitful:

- 1) Continued clarification of the concepts and their relationship to psychoanalysis in general.
- 2) Controlled observations and experimental studies aiming at the validation and revision of the concepts, as well as at the establishing of new hypotheses.
- 3) Integration of the Freudian theories with those of allied fields of group study.

#### THE EFFECT OF FRONTAL LOBE OPERATIONS ON THE ATTENTION PROCESS

(Publication No. 2648)\*

Daniel Elvin Sheer, Ph.D.  
University of Michigan, 1951

This is a study on the effect of therepeutic brain surgery on attention and distractibility. Two other questions, which arose from a review of previous studies were also investigated: 1) the effect of different operative procedures on psychological test performance; and 2) the relation of postoperative changes in test performance to time after operation.

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The patient population under study consisted of sixty schizophrenic cases, thirty operatees were subdivided randomly into three groups of ten each according to the operative procedures, venous ligation, orbital, and superior cortical ablations, and thirty cases were in the control group.

An extensive test battery was developed consisting of five different test series, involving simple psychomotor tasks in which the factors of distraction and attention could be experimentally isolated and measured. Three tests within each series were administered both before and after operation to secure a more stable measure. These test series were again administered to the operated group under nembutal sedation, followed by a control testing without nembutal. Follow-up studies were carried out with these tests six and twelve months after operation.

Comparisons were made between the operated and control groups on the mean difference between the mean change on one test series as compared with another. The following conclusions are drawn from these data:

1. The operations have a differential effect on tests requiring a greater degree of sustained attention and concentration.
2. There is a significantly greater distractibility after operation both with experimentally imposed external stimuli and with distractive elements in the test itself.
3. Memory recall is impaired after operation when the experimental conditions interfered with initial fixation and when attention is focused on other aspects of the stimulus situation.
4. Nembutal sedation increased efficiency of test performance in the operated patients as compared with the control testings without nembutal.
5. Four cases in the venous ligation subgroup with more extensive posterior operations and the superior subgroup showed a greater decrement in test performance which lasted up to twelve months after operation. The orbital subgroup recovered in test performance six months postoperatively.

The attention process was defined as directed motivation, and a neural system was developed which might mediate this process. Essentially it involved three links in an interacting chain: 1) the motivational energy, which comes from diencephalic, mesencephalic, and striatal integrative centers, mediated by reverberating circuits between the thalamo-reticular system and the cortex; 2) the component to which it is directed, the physical stimulus configuration, mediated by the afferent projection systems; and (3) the directing component, mediated by a brain wave scanning device. The specific internal image on which the scanning mechanism would lock is, in turn, directed by the thalamocortical circuits acting on interneurons between the complex neuronal patterns (memory function) in both the specific afferent and efferent projection systems.

It was proposed that the deficit in the attention process after therapeutic brain surgery results from a dysfunction in the complex neural interactions mediating this process, which, in turn, has been traced to a possible disturbance in glucose metabolism resulting from interference at the hypothalamic level. One important function of the frontal lobes in the neural system mediating this process is through its regulatory influence on diencephalic centers.

**FACTORS IN REMISSION OF SCHIZOPHRENICS:  
A COMPARATIVE STUDY OF PERSONALITY AND  
INTELLECTUAL VARIABLES AMONG SCHIZOPHRENICS**

(Publication No. 2659)\*

Bernard Alexandrevich Stotsky, Ph.D.  
University of Michigan, 1951

This study was concerned with the relation of certain personality and intellectual variables, as measured by the Wechsler-Bellevue and Rorschach Tests, to remission in schizophrenia. Predictions with respect to differences between remitting and non-remitting schizophrenics on certain test variables were derived from the theory underlying each of the two tests and tested on two samples. Each of the two samples consisted of a group of remitted and a group of non-remitted, or hospitalized, schizophrenics who had been tested soon after admission to the hospital. The subjects were white, male, World War II veterans, 40 years of age or younger, patients of Veterans' Administration hospitals, who were diagnosed as schizophrenic. Altogether there was a total of 148 subjects on whom Rorschachs were available (74 in each group) and 144 on whom Wechslers were available (72 in each group).

There were no significant differences between the remitted and hospitalized schizophrenics for age, education, occupation, marital status, religious affiliation, diagnostic subtype of schizophrenia, or number of previous hospitalizations. Comparison of the two groups of schizophrenics (in one sample) on 90 clinical and historical variables yielded differences only slightly greater than chance expectancy.

The average hospital tenure for the present schizophrenic episode was between three to seven months for remitted patients, over 30 months for hospitalized patients. There was no overlap between the two groups on length of hospitalization.

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On the Wechsler-Bellevue all three predictions concerning differences in IQ scores were confirmed in both samples. Significant differences in favor of the remitted group were found for both samples on Total IQ scores, for a single sample on Performance and Verbal IQ scores.

On the Rorschach 14 out of 18 predictions were confirmed in both samples (16 in each sample). Significant differences in favor of the remitted group were found on the following variables for both samples: "F+ %," "Extended F+ %," and "P." Significant differences in favor of the remitted group were found on the following variables for a single sample: "M" and ambiequality and introversion of "Experience-type." Significant differences in favor of the hospitalized group were found on the following variables for a single sample: "CF," "C," extratensiveness of "Experience-type," higher "W:M" ratio, "Position," and "Color-naming." The Rorschach findings suggest that emotional and intellectual functioning are less impaired among the remitted than among the hospitalized patients.

On the whole the test records of remitted schizophrenics tend to resemble those of normals more closely than do the test records of hospitalized schizophrenics.

Indices for use in predicting recovery or non-recovery of schizophrenics were derived from the four subtests of the Wechsler-Bellevue and seven variables of the Rorschach which differentiated the groups best. The Wechsler index classified 65% of the patients correctly, the best Rorschach index 72%.

#### A CRITICAL EXAMINATION OF MODERN SYSTEMS OF PSYCHOLOGICAL TYPOLOGY

(Publication No. 2517)\*

Charles Winick, Ph.D.  
New York University, 1950

This dissertation is a history and evaluation of several systems of psychological types which are in use in contemporary social science. The typologies of Freud, Jung, Rorschach, Horney, Fromm, Jaensch, Berman, Pavlov, and Spranger are considered. Each typology is discussed, wherever possible, from the point of view of its purpose, data, consistency, conformity with known facts, predictive power, pragmatic value, endorsement by experts, conformity with

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postulates of psychology, squaring with other systems, and sheer illuminative power.

Chapter I introduces the problem, and gives its delimitations, definitions, assumptions, and relevance. Chapter II provides an examination of the general literature of typology which indicates that opinions on the value of types have varied right up to the present. Trait theorists have claimed that traits explain personality adequately, while type theorists hold that a trait cannot be considered without the application of the broader concept of types.

Chapter III presents the oral-anal-genital typology of Freud and Abraham. Although there is a preponderance of evidence to confirm this typology, there is also evidence which appears to contradict it. The use of this typology by anthropologists and others is discussed.

Jung's introversion-extraversion typology is analyzed in Chapter IV. The typology's similarity to analogous systems and its possible physiological correlates are discussed. Its relations to racial characteristics, aesthetics, and mental illness are suggested. The confusion of introversion and neuroticism, the typology's verification by factor analysis, and recurring criticisms of it, complete the discussion.

Chapter V covers Rorschach's introversive-extravertive experience types. Similar systems, comments and criticism are given.

Horney's compliant-aggressive-detached types are discussed in Chapter VI. A criticism and evaluation of Horney's types is made.

Fromm's non-productive and productive orientations are analyzed in Chapter VII. Fromm's attitude to psychoanalytic typology, and to culture and personality types, are presented, with a criticism and evaluation of his system.

In Chapter VIII, Jaensch's eidetic types are presented, with criticism and comments on his Nazi leanings, as well as on his system. Berman's endocrine typology is analyzed in Chapter IX, along with other endocrine systems, experimental evidence, and criticism. Chapter X covers Pavlov's reflexological types. Spranger's six value types are presented in Chapter XI.

Chapter XII presents a summary, conclusions, and recommendations. None of these systems has been definitely validated. Several experiments which would elucidate some key questions are suggested.

## PSYCHOLOGY, PATHOLOGICAL

### A COMPARISON OF CONCEPT FORMATION IN POORLY-EDUCATED NORMALS, NON-DETERIORATED SCHIZOPHRENICS AND BRAIN-DAMAGED PATIENTS

(Publication No. 2512)\*

Louis M. Rosenberg, Ph.D.  
New York University, 1951

#### Problem

This investigation concerned the comparative performance of three groups of individuals — poorly-educated normals, non-deteriorated schizophrenics and brain-injured patients on a battery of concept formation tests.

#### Populations

The poorly-educated normals were individuals who were without a history of psychiatric or neurological disorders who did not have more than three years of vocational high school and who, in addition, were employed in occupations of an unskilled or semi-skilled nature. The average educational level of this group was somewhat more than one year of vocational high school.

The schizophrenics were cooperative, non-deteriorated patients (mostly paranoid) who were hospitalized for not more than two years.

The brain-injured group were non-psychotic individuals with damage to the frontal lobes due either to tumors or penetrating head wounds.

The three groups were equated for age and intellectual level. The educational level of the pathological groups was significantly higher than that of the normal group. There were 36 schizophrenics, 24 organics and 25 normals.

#### Test Battery

The battery consisted of seven tests, both verbal and performance in character:

1. Similarities from the Wechsler-Bellevue Scales.
2. List I — ten items involving vertical concept formation.
3. List II — ten items of horizontal concept formation.
4. Weigl Color-Form Sorting Test.
5. Color-Form Sorting Test II — an experimental modification of the Weigl Test, which was more difficult.
6. Object Sorting Test.
7. Figure Similarities.

\* Microfilm copy of complete manuscript of 413 pages, \$5.16.  
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In each test, the performance of the individual was evaluated from the viewpoint of his initial performance and his ability to gain from graded helps. With each test was a uniformed series of graded helps.

#### **Need for the Study**

Although conceptual losses in schizophrenia and organicity have been investigated, a study of conceptual impairment due to poor cultural background has been largely lacking.

#### **Summary of the Results**

1. The schizophrenics showed a marked superiority over both other groups in most of the conceptual tasks in the battery. There was evidence that they were over-developed or hypertrophied in their conceptual functioning as compared with their general intellectual level. In general, over-inclusiveness and unusual bases of categorization typified the group rather than concreteness and narrowed concept span. These findings were related to the personality dynamics of the schizophrenic in terms of: over-ideational activity of the schizophrenic; his suspiciousness which caused rejection of conventional response patterns and his retreat from living.

2. The performance of the organic group was generally typified by — concreteness of thinking, narrowed concept span, difficulty in shifting and striking inability to gain from aid. These difficulties were primarily evident in the more difficult conceptual tasks. In some of the organics, there was little or no evident conceptual loss.

3. The normal group avoided the pathological elements typical of the schizophrenics and organics.

4. Goldstein's concepts of the type of loss in the frontal lobe patient tended to be corroborated. Individuals with relatively poor educational backgrounds were able to gain from graded helps whereas organics had considerable difficulty in this learning process.

5. The experimental battery of tests provided diagnostic criteria which allowed for excellent differentiation of the three groups. The following tests were most useful — Lists I and II, Object Sorting Test and Color-Form Sorting Test II.

## SOCIOLOGY

### CASEWORK IN MARITAL DISHARMONY WITH EMPHASIS ON THE PART OF THE WIFE IN THIS DISHARMONY

(Publication No. 2562)\*

Florence Hollis, Ph.D.  
Bryn Mawr College, 1947

This is a casework study based upon the records of 100 couples showing marital disharmony and seeking help from eleven Family Service Agencies. Its two-fold purpose was 1) to gain greater understanding of some personality and situational factors associated with marital disharmony as revealed by the casework method and 2) to understand more fully both the strengths and weaknesses of present-day casework practice in this type of social maladjustment. The sample of 100 was so selected as to show the work of caseworkers considered competent practitioners by their employing agencies.

Several personality factors emerged as predisposing wives to difficulty in marriage adjustment — dependence, masochism, masculinity, lack of ego controls and certain types of parental ties. Too great dependence showed itself in the woman's inability to love unless she was completely secure in her husband's affection, with little or no capacity for generosity in her love during periods of stress. Through a strongly supportive treatment relationship or through insight, growth sometimes occurred. Not infrequently the only answer was separation.

Two types of masochism were distinguished — moral and erotogenic. In either, pleasure in suffering may lead to behavior which invites aggression in the marriage partner. In the former some modification was possible through supportive treatment. The latter carries a higher pleasurable element and is given up less readily and probably only through insight development.

Different degrees of masculinity were noted in a few cases with varying possibilities of personality change. In two cases increased femininity was achieved; in others it seemed easier to adapt the marriage to the reversed masculine — feminine pattern.

Where ego controls were weak, permitting strongly impulsive behavior, the possibility of modification seemed slight.

The effects of parental ties were traced both upon general personality development and upon attitudes toward the husband. Strong positive feelings to fathers, ambivalence to both parents, and strong negative feelings toward mothers appeared repeatedly. Treatment

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\* Microfilm copy of complete manuscript of 346 pages, \$4.33.  
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ranged from intellectual understanding to intensive treatment involving true insight.

Parental interference and parental ties were seen as interacting forces, the former usually causing conflict only when encouraged by the latter.

For the most part, the sex adjustment was unsatisfactory. In general this seemed to result from basic personality difficulties rather than from educational or cultural determinants.

There were no cases in the sample where differences in cultural background could be held primarily responsible for conflict, though in several instances these were of importance along with personality factors. Usually such differences were used merely as pawns in the conflict.

The weight of economic factors sometimes appeared to be great, particularly so when there was insufficient income due to economic conditions. Long-time economic suffering appeared to contribute to later instability. However, even here in our sample this was always accompanied by evidence of personality difficulties that also contributed to the conflict. In treatment the financial problem was usually dealt with in addition to the personality factors in cases showing considerable progress.

In addition to the discussions of treatment in connection with different factors throughout the text three chapters are devoted to general treatment considerations. Four primary psychosocial treatment processes are identified: "environmental support," "clarification," "psychological support" and "insight development." These processes are described in some detail with illustrations. Psychological support and clarification were found most frequently, with environmental support of next importance. Insight development occurred in only a few cases and is regarded as still somewhat experimental.

Common errors in treatment are analyzed in one chapter.

The 100 cases were rated on four point scales according to amount of change and according to quality of casework. Several examples illustrate each degree of rating. There was a marked difference between cases having three or less interviews and those having four or more. Improvement occurred in only 1/4 of the former but in 2/3 of the latter. Likewise the casework was good or fair in only slightly over 1/3 of the former but in over 2/3 of the latter. There was a definite relationship between quality of work and degree of improvement. Divergence between the skill of different workers lead to the conclusion that there is considerable knowledge of how to treat marital disharmony within the casework field but that this knowledge is not sufficiently widespread among practitioners.

## SECRET BALLOTS, OPEN BALLOTS, AND PERSONAL INTERVIEWS IN OPINION POLLING

(Publication No. 2540)\*

Raymond Alfred Kemper, Ph.D.  
Columbia University, 1951

By means of a modified area-random procedure, a sample of 1500 adult residents of Louisville (Kentucky) was selected, and the members were assigned to three comparable subsample groups. On the basis of within-group age-race-sex-socioeconomic distributions, the subsamples were random selections from a common universe. The data were collected, October 22-23, 1949, by thirty male senior-college students. One subsample was polled by the regular interview method, a second by means of secret ballots and sealed ballot-boxes, and the third group was polled by means of "open ballots" which were returned to the fieldworker after they had been completed by the respondent.

Essentially similar questionnaires — consisting of twenty "fact questions" and thirteen "opinion questions" — were used in the three subsamples. All of the "opinion questions," and seventeen of the twenty "fact questions," provided non-independent multiple-choice response categories; in the case of three of the "fact questions" the response categories were independent, and the respondent could elect more than a single response for each question.

Three comparisons were made of the data. The Interview results were compared with Secret Ballot results, Interview with Open Ballot, and Open Ballot with Secret Ballot results. The results elicited by questions with non-independent responses were compared by means of Chi-square; questions with independent responses were compared by means of Critical Ratio.

When results obtained in the Secret Ballot subsample were compared with those obtained in the Interview subsample:

- a) The proportion of "refusals" among negroes was higher in the Secret Ballot group;
- b) The proportion of "refusals" among Secret Ballot negro respondents was higher than it was among Secret Ballot white respondents at the same socioeconomic level;
- c) Real differences between methods were found with seven of the twenty "fact questions" and with nine of the thirteen "opinion questions."

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\* Microfilm copy of complete manuscript of 148 pages, \$1.85. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-283.

When results obtained in the Open Ballot subsample were compared with those obtained in the Secret Ballot subsample:

a) A significantly high proportion of "refusals" was found among Socioeconomic A & B, white respondents in the Open Ballot subsample.

b) Real differences between methods were found with six of the twenty "fact questions" and with eight of the thirteen "opinion questions."

c) Higher proportions of "undecided" responses were found among Open Ballot respondents with four of the thirteen "opinion questions."

When the results obtained in the Interview subsample were compared with those obtained in the Open Ballot subsample:

a) The proportion of "refusals" among negro respondents was higher in the Open Ballot subsample.

b) The proportion of "refusals" among Open Ballot negro respondents was higher than it was among Open Ballot white respondents at the same socioeconomic level.

c) Real differences between methods were found with seven of the twenty "fact questions" and with eight of the thirteen "opinion questions."

On the assumption that the Total Sample results provided the best parameter estimates available, the results obtained in each of the subsamples were compared with relevant results obtained when all subsample data were pooled. No logical patterning was discerned among the distortions observed in the "fact question" data. However, in the case of those "opinion questions" involving transitional issues, where there was a clearly noticeable opinion trend from a "departing point-of-view" toward a "coming point-of-view," a distinctive patterning was observed. Among Secret Ballot respondents, "coming points-of-view" received greater support, and "departing points-of-view" received lesser support. Among Open Ballot respondents, "departing points-of-view" received greater support, and "coming points-of-view" received lesser support. Results obtained in the Interview subsample were in essential agreement with those based upon Total Sample data.

### Conclusion

With certain types of opinion-poll questions, the three data-collection methods studies here — secret ballots, open ballots and personal interviews — do tend to elicit significantly dissimilar results.

CAÑAMELAR: THE CONTEMPORARY CULTURE  
OF A RURAL PUERTO RICAN PROLETARIAT

(Publication No. 2545)\*

Sidney Wilfred Mintz, Ph.D.  
Columbia University, 1951

The present study is an effort to analyze a general cultural change through field work in a specific Puerto Rican community, on the south coast of the Island. The basis of this change is seen to be embedded in the shift in economic organization of the south coast sugar industry, which occurred at the time of the United States occupation. This occupation brought with it new political traditions, new colonial policies, new technology, new markets, and great amounts of investment capital. These forces were introduced in a social and economic situation which had much earlier developed its own methods and means of industrial organization, its own cultural forms, and its own particular traditions and life-ways.

The shift from what is defined as the family-type hacienda to what can be called the corporate land-and-factory combine, marks the main focus of the change. Derived from it are numerous modifications in the culture of the people who were subject to the change and its effects, and the cultural accommodations or resistances to the change, developed by the people themselves.

The development of the corporate land-and-factory combine on the south coast of Puerto Rico came about in response to extra-insular forces: a growing demand for sugar for the United States market; the introduction of great amounts of United States capital for local expansion of the sugar industry; the development of extensive governmental and private irrigation systems; the intensified centralization of crop processing; and so on. The currently exclusive cultivation of sugar-cane in this zone, therefore, cannot be regarded as the "natural" result of local conditions. Rather, a particular kind of technology and a special scale of capital investment were imposed upon an area historically and environmentally fitted for wage labor, single crop, commercial agriculture.

In the course of the analysis of this culture change, four steps are completed: 1) the reconstruction of the cultural setting of the family-type hacienda way of life, 2) the description and functional analysis, where possible, of the chain of changes set off by the basic economic shift of the 1900's, 3) the description and interrelation of

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the diverse aspects of present-day culture in this community, tying this culture to the culture of the past, and 4) the suggestion of some generalizations about the nature of the basic change and its cultural effects, which may be cross-culturally applicable.

## SPEECH

### A DESCRIPTIVE BIOGRAPHICAL STUDY OF THOMAS CLARKSON TRUEBLOOD

(Publication No. 2631)\*

Loren LaMont Okey, Ph.D.  
University of Michigan, 1951

There have been many outstanding teachers in the field of speech education, but few, if any, have been intensively studied. Thomas Clarkson Trueblood was one of those teachers who left his impact upon speech education. Because of his pioneering in the field of speech, his many activities at the University of Michigan, and the wide influence exercised by him, it seems important that his work should be presented in some detail. This is a descriptive biographical study of him.

Much of the material has been gathered from the Thomas C. Trueblood Papers, deposited in the Michigan Historical Collections, University of Michigan. Other sources include information gathered from conversations with Dr. Trueblood during a four-year period (1947-50), excerpts from his manuscript autobiography, personal letters, journals, newspaper reports, his published articles, and interviews with his contemporaries. The author has quoted extensively from primary sources not only for interest value but to give an insight into the personality of the man himself.

The intention has been to make the study objective, and the material has been organized in a topical manner. The chapters in sequence describe Trueblood's early home life and youth, his education, his association with Robert I. Fulton, his establishment and work at the University of Michigan, his teaching methods and beliefs, his activity as a reader and speaker, his work as a founder and co-founder, and his honors. The final chapters are in summary.

Dr. Trueblood was born near Salem, Indiana, in 1856, and celebrated his ninety-fifth birthday on April 6, 1951. At this writing,

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\* Microfilm copy of complete manuscript of 242 pages, \$3.03.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
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May 2, 1951, Dr. Trueblood has the distinction of having been affiliated with the University of Michigan for sixty-seven years. He began his teaching career in 1874 and ended it August 12, 1926. Before coming to the campus, he and Robert I. Fulton founded the Fulton and Trueblood School of Oratory at Kansas City, Missouri. While teaching there, he and Fulton became itinerant teachers of elocution in colleges and universities. It was through this form of teaching that Trueblood came to the University of Michigan in November, 1884, and offered a course in elocution. Out of that single non-credit course developed credit courses in speech, and finally, a department of speech. As head of this new department Trueblood became nationally known as a teacher of debate and oratory, and an organizer of several speech associations and leagues. His organizational genius was not however confined to his own field, but extended into the area of faculty and student athletics. He traveled extensively at home and abroad giving lectures, readings and play recitals, and speaking in behalf of speech education.

No attempt has been made to evaluate the extent of the contributions of Thomas Clarkson Trueblood. The reader will have to judge for himself. However, one will undoubtedly observe that Trueblood was: 1) a pioneer in speech education, 2) the first to establish a separate speech department in any of the "large" universities, 3) one of the first to secure credit for courses in speech, 4) a founder and co-founder of several speech organizations, 5) probably one of the greats on the University of Michigan campus, 6) an inspirational and energetic teacher with a spirit of mission.

**DWIGHT L. MOODY: AN EXAMINATION OF THE HISTORICAL  
CONDITIONS AND RHETORICAL FACTORS WHICH  
CONTRIBUTED TO HIS EFFECTIVENESS AS A SPEAKER**

(Publication No. 2637)\*

Rollin Walker Quimby, Ph.D.  
University of Michigan, 1951

The purpose of this study was to determine the causes of Dwight L. Moody's effectiveness as an evangelistic speaker. The importance of the study arises from two facts: 1) Moody was one of the most popular religious speakers which this country has produced, 2) Moody is almost unstudied as a speaker.

\* Microfilm copy of complete manuscript of 418 pages, \$5.23.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
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Part I of the study is a short biography of Dwight L. Moody which summarizes those events in his life that are necessary to an understanding of his speaking career. The chronology of events shows that Moody devoted fifteen years to religious work before beginning the campaigns which brought him fame. The methods which attracted widespread public attention were developed during this apprenticeship period.

Part II of the study explores the historical setting in which Moody spoke and relates his evangelistic activities to the problems facing the American Protestant churches. The results show that although Moody did not create any new techniques unknown to other religious workers, he did supplement the work of the established churches by appealing to many segments of the population which, for one reason or another, were not in contact with the churches or their ministers.

Part III of the study examines Moody as a speaker. In delivery he was natural, direct, and energetic. In thought he confined himself to the basic message of the Bible as it related to the salvation of mankind. His style was simple and exceedingly vivid. Stories and illustrations were numerous. Although he did include some logical proof in his sermons, he believed ethical and emotional proof were more effective in attaining a favorable audience response. His chief defect as a speaker was his inability to use proper grammar. However, Moody's mistakes were minor and did not interfere with his ability to communicate an idea in a forceful manner.

Two general conclusions may be drawn from the material presented in this study: 1) Moody possessed many of the attributes of a good orator and would have acquired a following in any historical age, 2) Moody's effectiveness as a religious speaker was greatly enhanced because he spoke during a period of American history when there was a need for a good evangelist.

#### FORMULATION OF A DIAGNOSTIC WORD TEST OF HEARING

(Publication No. 2650)\*

Bruce Monroe Siegenthaler, Ph.D.  
University of Michigan, 1951

A hearing test using words selected to contain the phonetic variables of voicing, pressure pattern, and influence differences of consonants, was formed. The presence of these variables in the

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\* Microfilm copy of complete manuscript of 159 pages, \$1.99. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-391.

test words was verified by means of a sound spectrograph. Test items required the auditor to distinguish among words differing in the variables as well as to recognize words containing voiced and unvoiced consonants. Fifty-seven adult normal and hypacusic subjects were tested, and observations were made regarding the performance of subjects to evaluate the Word Test as a tool which would be diagnostic for type of audiogram or for aural disease.

Each subject was given a pure tone audiometric threshold test, most hypacusic subjects were given otological examinations, and a threshold of hearing for spondee words was obtained for each subject. The Word Test was administered at each subject's individual threshold for spondee words using recordings of all test materials and with listening done under a monaural earphone. Subjects were classified according to their audiometric and otological data and placed into homogeneous groups. Analysis of variance, t test comparisons, and correlation coefficients, were the statistical techniques used for the analysis of experimental data. In general, the 1% level of confidence was required for differences in subject performance to be considered significant.

A number of relationships among the performances of various types of subjects were observed as follows:

1. The rank order for correct responses to the Word Test was constant for all audiogram and otological groups considered. The rank order from highest to lowest per cent recognition was voicing differences, influence differences, pressure pattern differences, words containing voiced consonants, words containing both a voiced and an unvoiced consonant, and words containing unvoiced consonants.

2. The Marked and Trough shaped audiogram group of subjects had better perception for voicing differences than did the Normal, Rising shape audiogram, Conductive Deafness without perceptive involvement, and Otosclerosis groups.

3. The Marked and Trough shaped audiogram group had better perception for pressure pattern differences than the Normal group.

4. The Marked and Trough shaped audiogram group had poorer perception for words containing unvoiced consonants than did the Normal, Island loss audiogram type, Otosclerosis, and Conductive Deafness without perceptive element, groups of subjects.

5. Hearing loss above 2048 c.p.s. on the audiogram did not impair perception for words containing unvoiced consonants.

The results of the experiment indicate that the Word Test as formulated for this experiment is not diagnostic for type of audiogram or for otological disease. However, in view of the experimental data the following general conclusions were reached:

1. The Word Test indicates the presence of qualitative differences in the hearing of different subjects for certain phonetic factors at speech reception threshold.



2. The Word Test does not distinguish auditors with normal hearing from those with non-normal hearing.

3. The Word Test does not measure the same dimension of hearing as do audiometric and otological evaluations. Variations among subjects in Word Test performance are not related to classification of auditors into audiometric and otological groups, i. e., does not make such groups homogeneous with respect to Word Test performance.

4. The Word Test distinguishes among individual auditors, although the factors which account for the distinctions are not known.

5. The Word Test indicates the presence of a factor, or factors, in the perception of speech, tentatively called the perception for phonetic elements (in the present experiment for the phonetic elements of voicing, pressure pattern, and influence differences, and for voiced and unvoiced consonants), which is not indicated by the usual audiologic methods.

Although the above conclusions are largely negative for immediate clinical application, the study has definite findings in that the considered phonetic elements demonstrated differences among auditors. These differences next might be related to ability of auditors to hear in normal life situations. The Social Adequacy Index is a gross evaluation of this type, but a more fine measure of hearing ability in social situations might be possible using the Word Test method.

## THEATER

### SHYLOCK ON THE STAGE; SIGNIFICANT CHANGES IN THE INTERPRETATION OF SHAKESPEARE'S JEW

(Publication No. 2541)\*

Toby Bookholtz Lelyveld, Ph.D.  
Columbia University, 1951

The purpose of this study is to trace the significant changes in the manner in which Shylock has been interpreted in *The Merchant of Venice* in England and America so that the teaching of the play may be accompanied by an account of the social background against which Shakespeare's Jew was presented from Elizabethan times to the present day. While almost every leading actor on the English-speaking stage has undertaken the role, only those are included who departed from the traditions that had been established by their predecessors and who offered new characterizations of Shylock.

\* Microfilm copy of complete manuscript of 196 pages, \$2.45. Enlargements 6" x 8", 10¢ per page. Library of Congress Card Number Mic A 51-284.

Of greatest dependability in determining the quality of stage presentations have been the critical writings of those who witnessed them, the prompt-books, the memoirs of players and the journals of travellers. Playbills, records of theatre managers, log-books of theatres and annals of the stage have also provided rewarding sources of information. The libraries of Columbia University, Harvard University, Folger Shakespeare Library, the Stead Collection and the Robinson Locke Collection of the New York Public Library have been particularly helpful in making these materials available. Horace Howard Furness' New Variorum edition of The Merchant of Venice has served as a useful guide in determining the scope of this investigation.

Chapter I relates the political and social status of the Jews in England from the twelfth century through Shakespeare's days to the literary works that included references to Jews. It continues with a critical discussion of the ascribed physical appearance and the probable interpretation of Shylock in Shakespeare's day. The reopening of the theatres found the Jews who were residing in England eager to achieve civil status, and the details of the struggle are accompanied by an analysis of Granville's popular The Jew of Venice, a dramatic parody that is typical of the manner in which Shakespeare's writings were supplanted at this time. Dogget, the leading comedian of this era, interpreted the role of Shylock.

Chapter II is concerned chiefly with the first serious interpretation of Shylock that is recorded. The details of Macklin's conception of a monstrous Shylock, at the time when Garrick was engaged in raising the theatrical standards, are developed through the last decades of the eighteenth century.

Chapter III, "Edmund Kean and His Era," opens with an account of the first appearance of a black-wigged Shylock who was essentially tragic, analyzes Kean's treatment of the role and contrasts his interpretation with those of his outstanding contemporaries in the theatre. This chapter concludes with a consideration of the contributions made by Charles Kean during the early days of the Victorian era.

Chapter IV describes briefly the interpretation of Junius Brutus Booth, but is devoted largely to the Shylock of Edwin Booth and to the social climate in which it flourished.

Chapter V develops Henry Irving's conception of Shylock, its impact on the audience, Irving's approach to the study of the role, his reading of the lines and the decline of his interpretation in the light of modern drama.

Chapter VI, "Lesser Lights," deals with the leading Shylock actors of the modern theatre who invested the role with new readings, but whose interpretations do not warrant extensive analysis. Included here are the performances of William Poel, Beerbohm Tree, Arthur Bouchier, Richard Mansfield, A. E. Sothorn, Robert Mantell,

Walter Hampden, Maurice Moskovitch, David Warfield, George Arliss, Matheson Lang and John Gielgud.

Chapter VII, "Shylock Distorted," discusses the various ways in which the character of Shylock was employed in the second-rate theatre. Resumés of burlesque versions of The Merchant of Venice, literary and more serious adaptations of the Shylock theme and experimentations with the play in allied fields are included. Actresses, child-actors, elocutionists and burlesque performers who chose the Shylock role as a vehicle are cited. "Original" versions of The Merchant of Venice that were presented publicly are also included.

Briefly outlined, with the addition of a prefatory statement, an Epilogue and a Bibliography, as well as relevant notes throughout this study, this is a summary of the contents of Shylock on the Stage.

## THEOLOGY

### P. T. FORSYTH AND THE GOSPEL OF GRACE

(Publication No. 2525)\*

Robert McAfee Brown, Ph.D.  
Columbia University, 1951

The rediscovery of P. T. Forsyth (1848-1921) by the British theological world has made necessary some fresh examination of his thought. It has been discovered that in a remarkable way Forsyth anticipated, by fifty years, much of the discussion which is now current in theological circles, and that he has a number of contributions and correctives to offer.

This thesis deals with Forsyth's thought in terms of the centrality of the doctrine of Grace, Grace being interpreted not as an "infused quality" but as a new relationship between God and man made possible by the action of God in Jesus Christ. An examination of Forsyth's own life shows that after a period of theological liberalism he came to a new understanding in existential terms of the centrality of grace, and that thereafter his life was devoted to an exposition and elaboration of the bearing of the action of this "gracious God" upon the life of mankind.

Forsyth, however, did not return to an old "orthodoxy," but sought to reinterpret the Gospel for his day, without simply capitulating to the thought patterns of his day. There is an examination of the way in which he did this, and his method of dealing with the various problems which arose in the course of this reinterpretation.

\* Microfilm copy of complete manuscript of 759 pages, \$9.49.  
Enlargements 6" x 8", 10¢ per page. Library of Congress  
Card Number Mic A 51-268.

Since the doctrine of grace finds its center and its fulfillment in the person and work of Jesus Christ, the development of Forsyth's Christology is closely examined, after which the remaining chapters are devoted to a discussion of the relevance of the gospel of grace to various facets of human experience. The authority of the Church, the Bible, and the "individual" is seen, in each instance, to stand under the final authority of the gospel of grace. The centrality and priority of grace is found to be the source of power and motivation in the field of ethics. The meaning of human history is found to be best illumined by an understanding of the relation of God to human history in His decisive act in the Incarnation and Atonement. Finally, the gospel of grace is found to be normative for the life and meaning of the Church.

Two appendices supply further historical background for an understanding of Forsyth's thought, one discussing the "New Theology" controversy of 1907, and the second dealing with formative sources and influences on Forsyth's thought.

### CHRISTIANITY AND THE PROBLEM OF HISTORY

(Publication No. 2555)\*

Roger Lincoln Shinn, Ph.D.  
Columbia University, 1951

The problem of this thesis is the analysis and vindication of a Christian eschatology as an interpretation of history.

As an avowedly historical religion, Christianity has from its beginning confronted the problem of the meaning of history. It has asserted that the meaning of history is to be found only in the mysterious sovereignty of God. Here is involved a two-fold protest: first, against any lesser embodiment of the meaning of history, e. g., in national destinies or social organization; second, against any despair which finds history meaningless. Christian thought has expressed itself in an eschatological mythology, which affirms the sovereignty of God but insists that at any given moment that sovereignty is challenged and incomplete, awaiting fulfillment in a future judgment and kingdom of God.

The thesis undertakes the analysis of Christian eschatology by inspecting certain selected classical formulations. St. Augustine is taken as an expression of a normative, though not final, expression of Christian eschatology, inasmuch as it was he who adapted

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the literal eschatology of the New Testament to the expectation of a long-continuing history. In Augustine's interpretation may be discerned a three-stranded thread which guides the Christian as he moves through history. Each strand is indispensable to the Christian understanding of history: 1) The eschatological strand, with its insistence that God will fulfill history; 2) The ecclesiastical strand, which finds a foretaste or representation of the kingdom of God in the community of faith; 3) The dynamic strand, which relates faith in God to creative activity in history.

Various interpreters of Christianity have seized upon one or another of these strands. In Thomism the ecclesiastical emphasis submerges the other two. Lutheranism rediscovers and stresses the eschatological. The combination of Calvinism and some types of sectarianism has led to appreciation for historical performance of God's will. But each of these interpretations has neglected unduly one or more of the three strands.

The vindication of a Christian eschatology is undertaken through comparison of Christianity with some of the modern eschatologies which have challenged it, particularly the religion of progress and Marxism. In each case it is found that the challenges may be partially appropriated by Christian thought, for the clarification of its own insights. But each of the challenges is rejected as an alternative religion, because its presuppositions and categories are found less adequate to the variety and intensity of meaning found in historical experience.

Certain recent reinterpretations of Christian thought about history are examined to see whether they take adequate account both of the richness of Christian tradition and the challenges of modern secular thought. Catholicism in some of its expressions is found to have gone far toward appreciating the strands which Thomism neglected, but its movements in this direction are limited by its authoritative tradition. Protestantism's rediscovery of biblical eschatology in recent years has led to numerous creative reinterpretations of traditional Christian thought, sometimes at the cost of a loss of biblical historical dynamism. Toynbee's expansive interpretation of history actually is a combination, sometimes inconsistent, of three interpretations: the cyclical (without its traditional determinism), the progressive, and a progressive-ecclesiastical.

The conclusion of the thesis is that Christian faith in the sovereignty of God can vindicate itself only in terms of an eschatology, but that this eschatology must not ignore present intimations of God's providential sovereignty over history. An adequate Christian doctrine will re-weave the traditional thread, combining the three strands typical of Christian insight, but avoiding intellectual or ecclesiastical presumption. And it will be not so much a well-rounded "philosophy of history" as a confession of faith.

## WILDLIFE MANAGEMENT

### LIFE HISTORY, ECOLOGY, AND MANAGEMENT OF THE SOUTHERN WOODCHUCK

(Publication No. 2598)\*

Roy A. Grizzell, Jr., Ph.D.  
University of Michigan, 1951

This paper presents detailed information on the breeding habits, populations, food habits, mortality factors, habitat relationships, and economic position of the southern woodchuck. It is divided into six main sections: 1) the study area, 2) methods, 3) description of the animal, 4) biology of the woodchuck, 5) economic position, and 6) management. There is also a bibliography of the *Marmota monax* group. The investigations were conducted in 1947-49 at the Patuxent Research Refuge, U. S. Fish and Wildlife Service, Laurel, Maryland.

Information regarding woodchucks was obtained mainly by live-trapping, supplemented by shooting, den excavation, observation, tracking, and holding animals under simulated natural conditions in pens.

Information is presented which shows that the natural life span of the woodchuck is five to six years. Tree climbing woodchucks were encountered on three different occasions. Hibernation is progressive, the older and fatter animals going in first, followed by the yearlings and juveniles. The same order of precedence holds true as the animals emerge, the larger ones appearing first. Weight loss of a number of animals during hibernation was 30.45 percent. Loss of weight continued for several weeks after emergence.

Length of gestation periods were obtained for the first time during this investigation. Two captive females were mated with a single male, resulting in gestation periods of 32 days (plus or minus one day) and 33 days (plus or minus one day). An artificially inseminated female produced a litter in 31 or 32 days. An average litter of 4.6 young were recorded from 29 females examined. Weights proved to be an accurate and practical field method of aging woodchucks. The sex ratio of 215 animals was 1.03 males to 1 female.

Food habits studies in the spring and summer showed that red clover, white clover, grass, chickweed, and alfalfa were the foods eaten most often and in the largest amounts.

Den construction varied according to land use and site. The winter dens located in wooded areas usually had one entrance,

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rarely more than two. Summer field dens were characterized by a main entrance, with a mound of fresh soil and a smaller plunge hole, sometimes well concealed in the surrounding vegetation. Excavations conducted during the investigation further substantiated the theory that woodchucks hibernate in plugged off chambers. In the winter, heavy use of woodchuck dens by other animals was observed when the temperatures were below 20 degrees F. accompanied by strong winds. Home ranges were directly dependent upon the location of dens in relation to the habitat. Seasonal movements from the home area occurred in the spring shortly after emergence from hibernation, in the summer as the young dispersed from the home den, and again in the fall when the animals moved from the summer dens to hibernating areas.

Woodchucks are an economically desirable species from the standpoint of their ecological role in providing refuge sites for many of our game animals and furbearers. The trend in the legal and pest status is more and more towards recognition of the woodchuck as a game animal and less as a pest species. The most serious objection to woodchucks is the damage they do to crops, terraces, dams, levees, and machinery. Where the animal is present in woodlots, gullies, abandoned farms, odd areas, and brush land they should be encouraged. When they become too numerous on valuable farm land and truck gardens it may be necessary to take measures to bring them under control.

Control experiments in an area of a high woodchuck concentration proved ineffective when not followed by subsequent gassings and control on adjacent lands.

COMPARATIVE ECOLOGY OF THE COMMON GARTER SNAKE  
(*THAMNOPHIS S. SIRTALIS*), THE RIBBON SNAKE  
(*THAMNOPHIS S. SAURITUS*), AND BUTLER'S GARTER SNAKE  
(*THAMNOPHIS BUTLERI*), IN MIXED POPULATION

(Publication No. 2578)\*

Charles Congden Carpenter, Ph.D.  
University of Michigan, 1951

An intensive study of approximately 1600 snakes involving more than 2000 field records of the common garter snake, *Thamnophis s. sirtalis*, the ribbon snake, *Thamnophis s. sauritus*, and Butler's garter snake, *Thamnophis butleri*, was carried out with special concentration on a large population on a 48-acre area near Ann Arbor, Michigan. Extensive data on their food, habitat, and movements were recorded.

Growth is rapid in young garter snakes, then decreases throughout life. Evidence indicates that both sexes may mature by their second spring.

Food gathered by forced regurgitation in the field indicates significant differences in feeding habits between the three species and also between different size groups within each species. Availability of the prey to the snake is very important in determining the items eaten.

In spring and fall the three species occur together in high concentrations near hibernating sites, while in summer they show greater differences in habitat preference, which have direct correlations with food preferences.

Movements of all three species were found to be generally limited to between 2 and 3 acres; the term, "activity range," was proposed for these limited areas. Emigration and immigration were very slight. Movements tended to be restricted by type of habitat.

The mixed population at Cherry Hill was estimated to be composed of 482 Common Garter Snakes, 477 Ribbon Snakes, and 121 Butler's Garter Snakes. Adult size snakes formed a major portion of the population. The Common Garter Snake had the largest breeding potential and mortality and Butler's Garter Snake the smallest.

The three species, living closely associated in large numbers in the same area, exhibit significant differences in their food and habitat requirements, which enable them to live together.

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NATURAL TERRESTRIAL COMMUNITIES OF BREWSTER  
COUNTY, TEXAS, AND ADJACENT AREAS WITH SPECIAL  
REFERENCE TO THE DEGREE OF RESTRICTION OF  
CERTAIN SMALL MAMMALS TO PARTICULAR COMMUNITIES

(Publication No. 2581)\*

Helen Arliss Denyes, Ph. D.  
University of Michigan, 1951

This study is concerned primarily with: 1) a classification of the biotic districts, life belts, and ecologic associations of Brewster County, Texas; 2) an analysis of the factors that influence the habitat restrictions of several species of small mammals found in the Big Bend region of Texas.

Trap lines were laid parallel to sharp ecotones at measured distances into adjoining habitats. The significance of the differences between the number of each species caught in adjoining habitats was calculated by chi-square.

The significance of the differences between habitats in measurements of the amount of ground and crown cover based on data derived from fifty-foot line transects was calculated by chi-square. The soil from each habitat was analyzed by the hydrometric method. Four categories of soil compactness were established. The pH of the soil samples was taken with a Beckman potentiometer. The measures of other physical factors in habitats were visual approximations.

Brewster County, Texas, is included in the Chihuahuan biotic province and the greater part of the county, exclusive of the Stockton Plateau, is classified in two biotic districts on the basis of differences in climate, soils, and ecologic associations. Three life belts and twenty-four associations are described for the Chisos biotic district of southern Brewster County. Two life belts and fifteen associations are described as part of the Davis Mountain biotic district in northern Brewster County.

Comparison of adjoining habitats has served to identify certain influencing factors and combinations of factors which control the local restrictions of three species of pocket mice, one species of kangaroo rat, and three species of peromyscus. These factors are degree of soil compactness, nature of the surface, degree of slope, amount of ground cover, amount of crown cover, and the life form of certain plants.

The degree of habitat restriction for several of these species of mammals appears to depend not upon the absolute presence of

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certain factors but also upon the degree to which one or several of these factors is present in adjoining habitats.

THE RED AND BLACK PIGMENTS OF THE SALAMANDER,  
PLETHODON CINEREUS (GREEN)

(Publication No. 2601)\*

Emanuel Cassel Hertzler, Ph.D.  
University of Michigan, 1951

A laboratory study has been made of the pigments responsible for the color differences which are found between the striped and unstriped phases of the salamander, Plethodon cinereus (Green). Microscopic study of the skin of an unstriped animal reveals two types of pigment cells, melanophores and guanophores. They surround the cutaneous glands in the spongy layer of the dermis and line the cutaneous boundary. Melanin was confirmed in the black pigment cells by its occurrence as discrete granules in dendritic cells which react positively to the Dopa and ammonium silver nitrate tests for melanin. Similar microscopic study of striped skin reveals an additional type of pigment cell which, except for color appears to be very similar to the melanophores. The red pigment, however, reacts negatively to the Dopa and ammonium silver nitrate tests.

The embryonic appearance of melanophores (in both phases) occurs at the time when the branchial plate is dividing and there are twelve thoracic somites. No difference between the phases is evident until the second and third digits of the limbs are differentiated. Then, the dorsal melanophores migrate laterally and form a stripe. The first red chromatophores are visible just before hatching when the fourth and fifth digits are formed and when the gills are of maximum size.

Melanin is extracted slowly from skin by either hydrochloric acid or potassium hydroxide at concentrations varying from as much as 2 N to as little as 0.1 N. Spectrophotometric curves of the alkaline extracts are characterized by strong absorption below 270 m $\mu$ , rapidly increasing transmittancy between 270 and 320 m $\mu$  and gradually increasing but nearly unselective transmittancy from 320 to 1000 m $\mu$ . Acid extracts are similar except that there is a slight absorption band at 250 to 255 m $\mu$ .

The red pigment is extracted rapidly from striped skin by either hydrochloric acid or potassium hydroxide at concentrations of 2 N to 0.1 N. Spectrophotometric curves of the alkaline extracts have strong absorption below 270 m $\mu$ , and rapidly increasing transmittancy

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between 270 and 320 m $\mu$ . There is an absorption band between 320 and 350 m $\mu$  with a peak at 345 m $\mu$ . Acid extracts have an absorption band between 255 and 275 m $\mu$ , the peak of which varies with the acidity of the solvent. The curve of acid extracts has a stair case appearance with sharp increase of transmittancy at 300 m $\mu$ , 400 m $\mu$ , and 520 m $\mu$ . Alkalinizing an acid extract changes its spectral characteristics to those of an alkaline extract. In vitro oxidation of alkaline solutions of the red pigment produces a substance which resembles natural melanin in spectral characteristics.

By combining a microscope with a spectrophotometer it was possible to measure the transmittancy of pieces of living skin mounted in saline solution. The transmittance of red and of black pigmented areas is very similar to that of the acid extracts of the corresponding pigments. An adaptor was built for a spectrophotometer to allow spectral reflectance measurements of living animals. The reflectance curves of red and black skin areas are similar to those for transmittance of skin of the same areas and also to those for transmittancy of pigment extracts. Blood in the abundant cutaneous capillaries has no significant part in producing the red coloration.

The black pigment of *P. cinereus* is a typical melanin. The red pigment is closely related to it but is not similar to red pigments that have been described for human hair and chicken feathers. It is not similar to hallachrome nor to the red intermediate in melanin synthesis.

THE RELATION OF GULLS AND TERNS TO THE  
COMMERCIAL FISHERIES OF SAGINAW BAY, MICHIGAN,  
WITH PARTICULAR REFERENCE TO THE COMMON TERN,  
*STERNA HIRUNDO LINNAEUS*

(Publication No. 2501)\*

Canuto Guevarra Manuel, Sc.D.  
University of Michigan, 1932

The fishermen in Saginaw Bay, Michigan, believed gulls and terns, which were indiscriminately called "minnie gulls," caused great damage to the fisheries of the bay. On the other hand there were groups of people who held a contrary opinion. In order to establish a basis for an unbiased opinion, a study was undertaken jointly by the Institute for Fisheries Research and by the Museum

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of Zoology, both of the University of Michigan, with cooperation of the Department of Conservation of the State of Michigan.

These birds were studied in 29 places in Saginaw Bay, while most detailed and prolonged studies on Common Tern were carried out in two places. About 200 days were spent in the field in three long periods during 1929, 1930, and 1931. At other times during those years, studies were made in the laboratory.

A review of literature on the subject shows in general a strong bias in favor of the birds.

Six species of gulls and terns were noted to occur in Saginaw Bay. Of this number, the common Herring Gull, Larus argentatus Pontoppidan, and the Ring-billed Gull, L. delawarensis Ord., were not objectionable to the fishermen. On the contrary, they were believed to be beneficial, thus no study was made of them. Studies on Bonaparte's Gull, L. philadelphia (Ord), Black Tern, Chlidonias nigra surinamensis (Gmelin), Caspian Tern, Sterna caspia Pallas, and Common Tern, Sterna hirundo Linn., form the text of this paper. A more detailed study was made of the Common Tern because of its greater abundance.

In studying the birds, their peculiarities including the time of their arrival, their movements, association, nature of increase and decrease, and feeding behaviour were noted. The foods and feeding of the nesting birds and their young; their enemies, their seasonal abundance and the breeding peculiarities of the Common Tern were observed in detail. In addition, several experiments were carried out to determine the probable destructiveness of the Common Tern.

In studying the fish population of the bay, several factors assumed to be responsible for the relative abundance of the different species were taken into consideration.

The food of the birds was estimated by using both numerical percentage and the percentage by volume.

Whenever possible the figures were tabulated and a total of 46 tables are included. Several formulas were devised to estimate the quantity of fish eaten by each and all the species of birds studied and the extent of damage to fisheries. There are 16 illustrations arranged in 8 plates.

The results show that the Bonaparte's Gull was largely insectivorous in the spring, but in the fall it took to the abundant Lake Shiner, Notropis atherinoides Rafinesque, especially those individuals stranded in pools along the shore. A relatively insignificant quantity of Perch, Perca flavescens (Mitchill), fingerlings was also found to be eaten by the bird. It is believed that the destruction of the Bonaparte's Gull in Saginaw Bay during its migration would have no measurable beneficial effect on the fishery yield.

The relatively few Caspian Terns occurring in Saginaw Bay fed on commercial fishes, principally Perch and dead Lake Herring. It



is felt that the destruction of this rare species that feeds on a negligible number of Perch might accelerate its extinction.

The Black Tern fed on a variety of food, but insects comprise the larger part. The harm done by the bird, if any, is not sufficient to warrant the belief that the destruction of this species would have any beneficial effect on the fisheries of Saginaw Bay.

A three-year detailed study of the Common Tern to determine its direct or indirect relation to the commercial fisheries of Saginaw Bay shows that, in addition to being competitors of commercial and non-commercial fishes, it also preys upon both types. The number of Perch and Pike Perch fingerlings taken by the birds may seem alarming but careful consideration of several factors involved will lead to a conclusion that the destruction of the birds will not materially increase the production of commercial fishes.

Other fish predators, in particular the Lawyer, Lota maculosa, are vastly more destructive than are the birds.

#### AN ECOLOGICAL STUDY OF THE GREEN FROG, RANA CLAMITANS, IN SOUTHEASTERN MICHIGAN

(Publication No. 2622)\*

Bernard Stephen Martof, Ph.D.  
University of Michigan, 1951

Some features of the ecology of amphibians are generally not well known. This study of the physical and biotic factors which influence populations of green frogs is offered to aid in filling these gaps and to outline some of the major problems encountered.

In 1948 and 1949, 3,402 captures of 2,264 frogs were made on two study areas near Ann Arbor, Michigan. All were marked, studied, and released at the place of capture. Their behavior and location, the nature of the habitat, and general weather conditions were noted.

Weather conditions determined the season of activity, the intensity of breeding activity, the duration of the season of reproduction, the period and, to a great extent, amount of growth. Temperatures below 60 degrees F. and low humidities limited activity.

Eggs laid early in the long breeding season developed into frogs in the same year, whereas tadpoles from those deposited late did not metamorphose until the following year.

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The season of growth was primarily from mid-May to mid-September. It takes on the average about four to five years for an individual to grow from the egg stage to near maximum size. Sexual maturity was attained about a year after transformation, but generally these recently matured frogs did not become sexually active until the following year. No marked sexual dimorphism in maximum size occurs in this species.

The habitat niche of the green frog was the banks of streams and their surroundings, where they had definite home ranges averaging about 100 square meters. The small frogs established in shallow water sites and were mainly diurnal; on the other hand, the large ones selected ranges near deep water and were chiefly nocturnal.

About half of the large frogs were captured again, but less than five per cent of the newly transformed frogs were recaptured. In general a rapid turnover of population, due chiefly to predation and dispersion, occurred.

During the season of reproduction males were found in great abundance in the breeding sites, whereas females comprised about 80 per cent of the population along the stream. At other times, approximately a one to one ratio of the sexes existed.

The population of green frogs was smallest in July and early August, when the overwintering tadpoles had metamorphosed and dispersed, and the present season's larvae had not yet transformed. In August and September the peak of metamorphosis occurred and the number of green frogs was at its highest level.

Males in the breeding ponds were more or less evenly spaced with the average nearest distance between individuals being two or three meters. Some small groups of males maintained for as long as 40 days clusters within which the frogs had the same general orientation even though overland movements, some as far as 110 meters, had occurred. Thus within the breeding congress there was some social organization which strongly indicated a crude kind of territoriality.

COMPARATIVE MORPHOMETRY AND GROWTH OF SCALES  
IN THE BLUEGILL, *LEPOMIS M. MACROCHIRUS*  
RAFINESQUE, WITH SPECIAL REFERENCE  
TO RELATED BODY GROWTH

(Publication No. 2636)\*

Max Arthur Proffitt, Ph.D.  
University of Michigan, 1951

The purpose of this investigation has been to clarify the relationship of scale length (anterior radius) to body length in the bluegill. The method involved preliminary measurement and study of all scales on the bodies of six adult specimens, followed by an intensive analysis of scale growth and variability in 2,200 fish. Considering horizontal rows of scales, early growth is strongest in the "mid-side line," a row of scales which covers the horizontal skeletonous septum throughout most of its length. The first scales to appear are on the caudal peduncle, as in other Centrarchidae. Investiture with scales begins at a total length of 14 mm. and extends to the conventional sampling area (middle of the side) at 17 or 18 mm. in total length.

In the bluegills studied, all of the scales of the mid-side line possessed annulus I. Many of the smaller scales of the body lacked records of one or more of the first years of life. The scales with the most distinct annuli were those along the posterior border of the cleithrum. No evidence of growth-rate effects upon scale number (mid-side line count) was discernible in a sample of 280 age-group IV bluegills from a single population. A comparison of mid-side line counts of two Michigan populations separated in latitude by 300 miles was undertaken to determine whether the results would conform to the generalization that fish from northern waters have more scales than those of a more southerly distribution. In this instance, 151 bluegills from the northern locality averaged only 39.17 mid-side line scales whereas 320 from the south averaged 41.54 scales. There was no measurable difference in scale number nor in scale size between the two sexes.

The pattern of regenerated scales on a fish can indicate something of the nature and extent of former injuries. For example, the examination of one age-group IV bluegill showed that it had been half-denuded in its second year, and the shape of the area of regenerated scales was suggestive of the jaw mark of a predator. Further,

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it appeared that only two injuries accounted for 95 per cent of all the regenerated scales on the specimen. The percentage of regenerated scales varied tremendously from one population to another (e. g., 60 per cent of all scales from one population were regenerated, as against only 8 per cent from another population) and was evidently correlated with predation. The percentage also increased with fish size to a total length of 100 mm., from which point little further scale loss, and presumably less predation, occurred. Scale loss was similar in both sexes.

It was determined experimentally that localized injury could cause accessory or false annuli to develop on scales directly affected by the injury. Ordinary handling (that is, changing tanks, weighing, and measuring) of juvenile and adult bluegills did not result in formation of false annuli. Generalized false annuli (those present in all of the scales of the body) may be a rarity in wild populations in Michigan.

Exceptionally large or small scales tend to remain proportionately large or small throughout their entire span of accretion.

Comparison of body-scale curves for three populations showed that they were not directly proportional. Because of this, interchange of the curves in calculation of past growth could result in errors ranging from 0 to 4 mm. Body-scale curves for different key scales from one population showed sufficient variation to engender errors as high as 17 mm. total length by their interchange (i. e., calculation of growth by projecting the dimensions of one key scale upon the curve constructed for another key scale). Variability of the scales was such that 23 fish in each 5-mm. size-group of one population would afford means within 2 per cent of the true means with 95 per cent certainty, whereas 33 would be required in each group from another population.



THE COMPARATIVE MYOLOGY OF THE MAMMALIAN  
GENERA SIGMODON ORYZOMYS, NEOTOMA,  
AND PEROMYSCUS (CRICETINAE), WITH REMARKS  
ON THEIR INTERGENERIC RELATIONSHIPS

(Publication No. 2643)\*

George Clark Rinker, Ph.D.  
University of Michigan, 1951

The purposes of this study are to describe the myology of the genus Sigmodon (cotton rats), to compare the musculature of this genus with that of Oryzomys (rice rats), Neotoma (wood rats), and Peromyscus (white-footed mice), to determine, on this basis, the interrelationships of the four genera, and to search for evidence bearing on the derivations or homologies of muscles of mammals in general.

The body of the work consists of descriptions of the individual muscles of Sigmodon, and the comparison of corresponding muscles of representatives of the genera Oryzomys, Neotoma, and Peromyscus with those of Sigmodon and each other genus. Where evidence pertaining to the homology or phylogeny of muscles was discovered, it is discussed under the heading of the appropriate muscle.

The number of corresponding muscles which have similar relationships in all four genera is almost half the total number of muscles examined (111 of 228). Of the remaining muscles, 70 were found to have similar relationships in Sigmodon and Oryzomys, and 71 to have similar relationships in Neotoma and Peromyscus. In any other combination of two of the four genera, however, no more than ten of these remaining muscles present similar relationships. In addition to the mere numbers of corresponding muscles with similar relationships in pairs of genera, the similarities and differences fall into a pattern which is believed to be additional evidence pertaining to the phylogeny of these four genera.

In addition to several conclusions having to do with myological problems, two general conclusions may be drawn. 1) Sigmodon and Oryzomys are much more closely related than either is to Neotoma or Peromyscus, and these last two genera are related to approximately the same degree as are the first two. 2) The four genera were not derived independently from the common stock of the subfamily Cricetinae, but rather each pair evolved from a different secondary stock. That is, the common subfamily stock first split

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up into two (or more) secondary lines, and specialization within one of these secondary lines gave rise to Sigmodon and Oryzomys, while specialization within another secondary line produced the genera Neotoma and Peromyscus.

## GROWTH IN TETRAHYMENA IN RELATION TO CARBOHYDRATE METABOLISM

(Publication No. 2651)\*

John Vernon Slater, Ph.D.  
University of Michigan, 1951

The purpose of this investigation was to study certain aspects of growth in relation to carbohydrate metabolism in the ciliate protozoon, Tetrahymena. First, the effect of glucose on growth was determined. Then citrate, fumarate, succinate and pyruvate, which are known to play important roles in respect to glucose breakdown, were studied. The control of carbohydrate metabolism by the vitamins, thiamine and pantothenate was ascertained. The new growth factors, protogen and acetate-replacing factor, were also investigated in respect to the amount of glucose substrate. Finally, the effect on growth of the enzyme inhibitor, malonate, was determined.

Tetrahymena geleii (strain E) was chosen for this investigation because its growth characteristics in respect to nutrition are well understood. Growth is known to be a very sensitive index of substrate utilization and was, therefore, used in determining the effects of materials known to influence carbohydrate metabolism. An increase in protoplasmic mass was interpreted as growth. This was determined by means of a Klett-Summerson photo-electric colorimeter in which a blue filter was employed (420 mμ). The instrument was calibrated in terms of number and volume of animals, and age was found to influence optical density. Calibration curves are presented.

All cultures were inoculated with approximately 1000 animals. Cultures were maintained in the dark at 25° C. and checked at 12 hour intervals.

Maximum growth was obtained in the presence of 1500 γ/ml. of glucose. Concentrations of glucose as high as 0.2% proved toxic. Acetate was found to replace glucose.

Succinate and fumarate, of the intermediates tested, had no effects on growth. Citrate and pyruvate were inhibitory in the

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presence of glucose. Pyruvate was stimulatory in the absence of glucose.

Protogen and thiamine were of value in preventing the toxic action of glucose at high levels. Acetate-replacing factor and protogen appeared to be identical except that high protogen concentrations seemed to be slightly inhibitory.

Malonate inhibited growth in the absence of glucose. This inhibition was released by means of high concentrations of magnesium. Succinate and yeast nucleic acid had no effect on malonate inhibition. Slight growth was obtained in the absence of magnesium, but levels as low as 1  $\gamma$ /ml. produced maximal growth in the presence of glucose.

In conclusion, glucose was found to be an adequate nutrile, but it was toxic in high concentrations. The Krebs intermediates tested were either inactive or inhibited growth in the presence of glucose. Acetate was able to replace glucose. Certain of the metabolites active in glucose metabolism were able to protect the protozoan population from the deleterious effects of glucose. Magnesium was able to release malonate inhibition of growth.

SURVIVAL RATES, LONGEVITY, AND POPULATION  
FLUCTUATIONS IN THE WHITE-FOOTED MOUSE,  
PEROMYSCUS LEUCOPUS, IN SOUTHEASTERN MICHIGAN

(Publication No. 2654)\*

Dana Paul Snyder, Ph.D.  
University of Michigan, 1951

A study to determine survival rates and longevity in Peromyscus leucopus was carried out on the Edwin S. George Reserve of the University of Michigan. Data were obtained by live trapping, marking, and releasing the mice from July, 1949, to February, 1951, in an oak-hickory woodlot 22.2 acres (9.0 hectares) in size.

During the study 566 individual Peromyscus leucopus were captured a total of 1755 times. The density, calculated by using an adjusted area to account for individuals living partly inside and partly outside the trapped area, varied from 0.7 to 2.9 individuals per acre (1.7 to 7.2 per hectare). The highest density occurred in the fall of 1949, the lowest in January, 1951.

The rate of disappearance of marked mice from the study area was found to be essentially constant (with minor deviations) with

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respect to age for mice over five weeks and was similar for equivalent seasons during both years of the study. The deviations from the constant rate did appear to be systematic and later study may show them to have biological significance, particularly in the five- to nine-week age groups.

It was pointed out that in order to maintain an age-constant rate of disappearance, mortality and emigration rates would either have to remain constant with age or would have to vary inversely with age. The former case was accepted as being much simpler in mechanism of operation. The actual mortality rates were inferred from population shrinkage during the winter seasons. The rates for the two winter seasons were 0.074 per two-week interval in 1949-50 and 0.246 per two-week interval in 1950-51. These were tentatively considered to be near the minimum and maximum, respectively, and a survival table was constructed for each rate considering it age-constant. Under the lower rate the mean duration of life for mice which reached five weeks of age would be 31.4 weeks, and one individual out of 1000 aged five weeks would reach 197 weeks. Under the higher rate the mean duration of life for mice reaching five weeks would be 12.8 weeks with only one individual out of 1000 aged five weeks reaching 53 weeks. The actual rates were thought to fluctuate from season to season throughout the year so that these figures would represent only the limits. It was not considered feasible to calculate average longevity from birth since mortality rates for ages up to five weeks are unknown.

The ratio of mean to potential duration of life was used to compare small, relatively fast breeding species with high population densities with slower breeding, low density species. A low ratio (5 to 10 per cent) and age-constant mortality rates (after very early life) are characteristic of the former under natural conditions, while a high ratio (50 per cent or higher) and age-specific mortality rates appear to be characteristic of the latter.



## THE ECOLOGY OF MICHIGAN COYOTES AND WOLVES

(Publication No. 2657)\*

Adolph Marvin Stebler, Ph.D.  
University of Michigan, 1951

The ecology of coyotes and of timber wolves is especially important because of the position these species occupy in the food chains of natural communities. Except where man interferes, they are at the peak of the "pyramid of numbers." While knowledge of the food habits, the social relations, and the population dynamics of these species is essential to an understanding of their positions in nature, this knowledge is lacking generally for eastern North America. This lack of precise ecological information is not surprising, however, when the difficulties of observing these elusive mammals in the field is considered.

In this investigation, the snow-trails of coyotes and wolves were followed, mostly on snowshoes, in the endeavor to learn the daily habits of the animals. The study of the coyote was conducted mainly, and that of the wolf entirely, in the Michigan northern peninsula.

Information is presented which shows that in Michigan during the winter, coyotes commonly travel and live together as mated pairs. The winter band of this species, therefore, is usually composed of only two individuals. A winter pack of timber wolves usually consists of a mated pair plus one or more additional individuals. The largest Michigan pack here reported consisted of six individuals. Both the coyote and the wolf manifest a high degree of sociality, which is greater among wolves, as attested by the more enduring nature of the wolf family unit, and by the living together of adults other than a mated pair.

Each band of coyotes or of wolves lives upon a home range somewhat variable in area, which is the area within which the sum of the daily and the seasonal activities of these mammals takes place. The home range of a band of either species appears to be exclusively its own. The home ranges also may be defended territories, but the evidence for this is not conclusive.

According to the available information, the average size of a Michigan coyote litter is 5.8 pups, while that of the wolf is 7.3 pups. In both species, the sex ratio is approximately 1 : 1. Coyotes may reach sexual maturity at the age of one year, whereas wolves

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apparently do not do so until they are nearly two years of age. From formulae based upon the average annual population toll, average density of the winter band per home range, average size of litter per mated pair, number of litters per pair per year, and the assumed number of breeding pairs per home range, it is estimated that during the 15-year period 1935 to 1949, inclusive, there was an average breeding population of about 445 mated pairs of coyotes in Michigan. The coyote population suffered an average annual bounty toll of 72.5 percent. It is further estimated that during this same period there were about 5 mated pairs of wolves. The wolf population suffered an average annual bounty toll of 62.9 percent. The long term trend of the Michigan coyote population has been one of increasing range and density, while that of the timber wolf has been one of decreasing range and density.

Under Michigan conditions, the food of the coyote in winter consists mainly of snowshoe hares, voles, and deer carrion. In the autumn, grasshoppers and wild black cherries may become important supplements. The winter food of timber wolves consists largely of deer, which they themselves have killed.

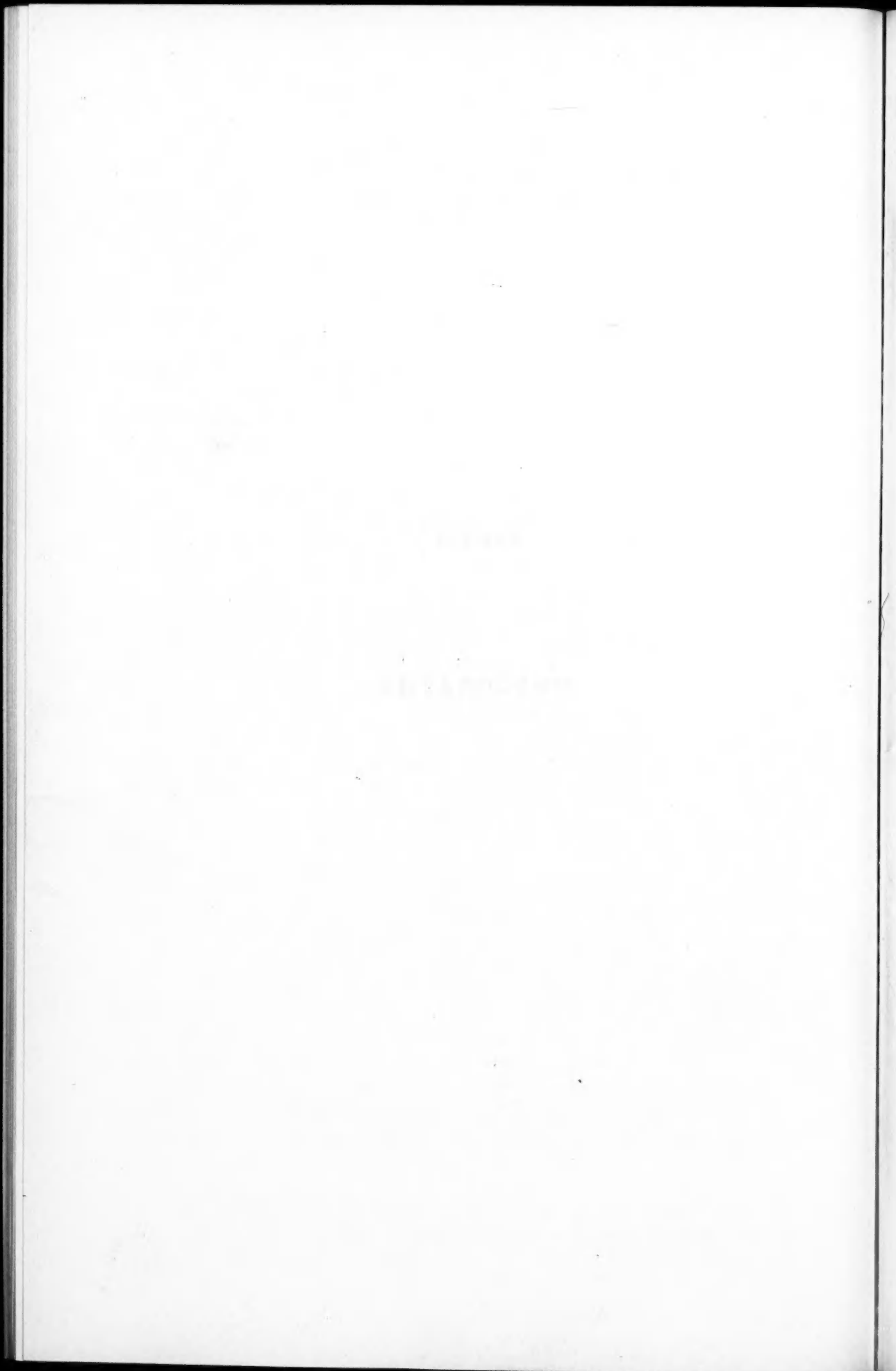
The role of coyote predation upon the biotic community under present Michigan conditions is principally one whereby the coyote aids in the regulation of the population densities of the small, herbivorous mammals. Their predation upon large mammals and upon birds in winter is negligible. The role of timber wolf predation is toward regulation of the deer herd size. It is difficult to ascertain precisely the effectiveness of this regulatory action. Damage to the vegetation by deer is less severe in the northern peninsula where wolves are present, than elsewhere in Michigan where they are absent.



## PART II

### MONOGRAPHS





## LANGUAGE

### THE DIALECTS OF ANCIENT GAUL

(Publication No. 2495)\*

Joshua Whatmough, M. A.  
University of Cambridge, 1926

Whatmough, Joshua (1897- )

The Dialects of Ancient Gaul (continued, see Microfilm Abstracts vol. x, No. 1, 1950, pp. 141-142, Pub. No. 1571; No. 2, 1950, pp. 175-176, Pub. No. 1733; No. 3, 1950, pp. 265-266, Pub. No. 1911; vol. xi, No. 1, 1951, pp. 207-208, Pub. No. 2319).

This is the fifth and last part of the documentary portion of the work, viz. the records of the dialects. Its contents (pp. 985-1376) are as follows:

VII. GERMANIA SUPERIOR (West of the Rhine)	Pages
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Note lii Items in Latin Inscriptions	988-994
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226, 227 The Calendar of Coligny and the fragment from Lac d'Antre	994-1060
228 Names of Potters, Germania Superior	1060-1073
229, 230 Graffiti of Blickweiler and Rheinzabern	1073-1076
Note liii Graffiti of Vertault and elsewhere	1076-1078
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231 Names on Tiles	1079
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Note lix Dialect Inscription from the Danube	1174-1176

\* Microfilm copy of complete manuscript of 396 pages, \$4.95.  
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238 Names of potters, and abecedaria	1176-1179
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DISSERTATION ABSTRACTS

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